

Advances in phenotyping through digitisation

Interview with Prof. Dr. Reinhard Töpfer, Head of the Institute for Grapevine Breeding Geilweilerhof at Julius Kühn-Institut (JKI)

The conference "Viticulture 4.0 - Digitisation in the process chain", which will be held on the 5th of November 2018 within the framework of the 63rd International DWV-Congress, highlights many aspects.



These include the use of digitisation in phenotyping. We asked Prof. Dr. Reinhard Töpfer, head of the Institute for Grapevine Breeding Geilweilerhof at the Julius Kühn-Institut (JKI) in Siebeldingen, what this term means and which aspects should be discussed at the conference in Stuttgart.

The phenotype of a vine is important for vine breeders. What is the phenotype and why is it important?

Töpfer: The phenotype describes how a characteristic of a plant in a given environment is pronounced: does it ripen early or late, has it large or small berries, etc. This phenotype is then used in breeding as a selection criterion. The essential selection decisions are to be made especially during harvesting – the good can be separated from the bad. The time constraints in the autumn limit the capacity of collecting phenotypic characteristics, so that only selected breeding material can be intensively evaluated. Therefore, the breeding efficiency can be significantly increased by the application of new phenotyping methods – quick, sensor-based, automated, and with high precision.

How are the traits captured by the vine breeders? Can breeding goals be achieved much faster?

Töpfer: Hitherto, the evaluation of the breeding material has been carried out partly by measuring, for example the yield (grape weight), or by estimation, for example of the degree of resistance. Inevitably estimates always suffer from the subjectivity of the observer. It is important for breeding that intensified sensor-based data collection, in addition to an intensified recording of the characteristics of the grape harvest, would primarily focus on early development phases such as bud break, flowering and veraison in the context of climate change. An acceleration is experienced by the application of genetic fingerprints to early selections.

New sensors in combination with digitisation open up new possibilities...

Töpfer: Sensor-based data are objective. In viticulture it must be taken in the field under very variable conditions and therefore requires standardisation. Image-based datasets provide retrospective ways of evaluating vines. In this way the characteristics of a seedling could be reproduced using image data from the last few years. The experience-based estimate is a one-time value that can no longer be questioned. From the detailed characteristics recorded within the context of the breeding procedure applications can be derived for the winegrowing process. In the foreseeable future, the sensor-based estimation of yields will be possible and thus lighten the planning for the wine cellar.

Who are the drivers of this development? Do you expect updates from exhibitors at INTERVITIS?

Töpfer: Many things are already possible in research - prototypical - as will be seen in the special show Drones and Robotics. However, the way towards implementation is long and will be determined by demand and economic considerations. Not every application imagined today will be a product of tomorrow. Winegrowing is a relatively small and very specialized sector compared to the agriculture in general. Winegrowers must formulate their own requirements and be ready to use the products on their vineyards. Only then can they convince producers to go into product development. Digitisation and automation are important where peak workloads are at breaking point, profitability issues can be resolved by abandoning vineyards (steep slopes) or relieving routinely stressful situations. Large markets are the driving forces for digitisation and automation. Autonomous agricultural machinery is a perspective for agriculture. However, we should not look naively into the digital world. A discussion on socio-economic aspects of digitisation needs to

be conducted. My wine should continue to grow in the vineyard and develop in the cellar. A digital wine from "4D printing" does not fit into this world.

The technical progress is evidently so gigantic that it is not so easy to stay on the ball. You're moderating the session "Phenotyping in Viticulture" at the 63rd International DWV-Congress. Who should definitely attend the session?

Töpfer: Digitisation is changing our world. We are at the beginning of this development. Winegrowers should look at what is being researched into and what is already possible. Their feedback provides the impetus to stimulate further research and to initiate product development from research results. This dialogue is the beginning of value-adding and supportive digitisation for the future. Innovative participants in the market, in associations and the political body are appealed to and asked to actively give digitisation a clear direction.

For further information check: <https://www.youtube.com/embed/YhieDJPfPxY> „Phänotypisierungsroboter im Weinberg: BMBF-Projekt PHENOvines“