



Switzerland at the forefront of sustainable production

Switzerland is set to host the 42nd OIV World Congress, presenting an opportunity to highlight its historical and innovative role in sustainability in wine production – an issue that interests the international scientific community and is increasingly capturing public attention. Both in the implementation of new, more environmentally friendly cultivation practices and through the development of interspecific vine varieties with natural resistance to vine diseases, Switzerland has been contributing to pioneering work for over half a century.

The structure of Swiss research

Swiss agricultural research relies upon internationally recognised institutions such as Agroscope, the Swiss federal centre of excellence for research in the agriculture and food sector; the CHANGINS School of Viticulture and Oenology (HES) and Zurich Federal Polytechnic Institute (ETH). Other Swiss universities collaborate from time to time on particular themes of agricultural research.

More specifically, the research carried out by Agroscope in viticulture and oenology is both fundamental and applied. It seeks to solve the practical problems of winegrowers, taking into account scientific data and specific regional characteristics. With this in mind, different areas of experimental research are carried out across the entire national territory, making it possible to study viticultural issues within the specific conditions of each region. The infrastructure of microvinification ensures the monitoring of viticultural and oenological trials right through to the finished product, including sensory analysis. Important analytical equipment forms the basis of microbiological and chemical research throughout all of the stages of grape maturation and wine production.

A small territory and diversity of situations

Given its geographical and topographical position in the heart of the Alps, Switzerland is characterised by a great diversity of soils, climates and microclimates. It is possible to group these into four distinct climate regions:

- eastern Switzerland (with a temperate, rather cool, relatively humid climate),
- the Lake Geneva area (with a temperate, rather mild, intermediate climate),
- Ticino (where a sunny, hot and humid, almost tropical climate dominates due to heavy rainfall),
- Valais (which is sunny, hot, very dry, and experiences periods of Foehn – a hot, southerly wind).

Agroscope's vitivincultural research experiments are conducted over a significant number of years using the same methodology, ensuring a high level of reliability of results.



The cradle of integrated control

It is a little-known fact that Switzerland is the cradle of integrated production. In the 1970s, a group of researchers began to reflect upon the long-term consequences of the excessive use of phytosanitary inputs, following the emergence of the first signs of resistance. Here we should emphasise the fundamental and pioneering contributions of the Swiss entomologist Mario Baggiolini, whose work, conducted at CHANGINS, essentially concentrated on orchard and vineyard fauna. His experiments were focused on implementing phytosanitary defence systems based on the notion of the tolerance threshold and making better use of natural mechanisms involved in the reduction of arthropod populations. Phytosanitary product application was only carried out as a last resort, with particular attention being paid to choosing products that should have the least undesirable secondary effects, and biological methods being prioritised. The principles of integrated control were then applied to the entire system of cultivation practices, vine training, soil management and plant feeding, to arrive at the current concept of integrated production.

Used with successful results in numerous pilot orchards in French-speaking Switzerland, the concept of integrated production was subsequently applied in all Swiss vineyards.

Today, this approach is used in vineyards the world over, with proven results: the decrease or even elimination of insecticide and acaricide treatments, the depletion of pest populations thanks to the re-establishment of certain equilibriums, the development of biological protection methods – such as mating disruption, for example – or even the reduction of risks of undesirable residues in grapes.

Agrometeo, an indispensable forecasting tool

Agrometeo is a platform that provides producers with decision-making tools for the management of phytosanitary protection in viticulture and arboriculture. It is based on a network of over 150 autonomous stations that supply microclimate weather data used by different models of risk forecasting for fungal diseases and pests.

The meteorological module makes it possible to access weather data measured by stations that constitute a key part of Agrometeo. The interface for extraction of weather data makes it possible to consult the climate parameters for a specified place and time period. The measuring stations transmit the measured values on a daily basis at 10-minute intervals.



The models for the forecasting of fungal disease infections and pest development are based on knowledge of the biology of these organisms in relation to determining weather factors. These are decision-making tools that allow for the evaluation of disease or pest development, and provide guidance for treatment decisions. Models are currently available for grapevine downy and powdery mildew, grape berry moths, apple scab and fire blight. Since 2009, 5-day weather forecasts have been integrated into the models for downy and powdery mildew and grape berry moths. This makes it possible to make real risk forecasts.

A cutting-edge viticultural selection programme

One of the strategies announced in Switzerland's 'Plan d'action visant à la réduction des risques et à l'utilisation durable des produits phytosanitaires' (Action plan for risk reduction and the sustainable use of phytosanitary products) is the continuation of Agroscope's varietal selection programme launched in the 1960s. For viticulture, the primary objective is to develop new vine varieties with natural resistance to vine diseases.

Numerous red and white vine varieties with high oenological potential have thus been created. Traditional techniques for cross-breeding between varieties of *Vitis vinifera* (or intraspecific hybridisation) have firstly made it possible to obtain vine varieties that are relatively insensitive to botrytis. The best known among these is Gamaret, created in 1973, now the 4th most-cultivated red variety in Switzerland. In France, the Beaujolais designation is interested in this vine variety derived from cross-breeding of Gamay and Reichensteiner. Since 1996, the varietal creation led by the Swiss teams has focused on obtaining vine varieties resistant to downy (*Plasmopara viticola*) and powdery (*Uncinula necator*) mildew by traditional interspecific hybridisation. In an initial phase, Gamaret, the European genitor (*Vitis vinifera*) showing high qualitative potential with exceptional resistance to *Botrytis cinerea*, was crossed with vine varieties carrying resistance genes derived from wild American and Asian vines. To accelerate and secure the selection process, Agroscope's mycology group implemented early tests to select candidates with high resistance to downy mildew. Biochemical criteria were developed based on the vine's natural defence mechanisms (stilbene phytoalexins) and integrated into varietal selection programmes. Since 2009, a joint (co-breeding) project for the selection of resistant varieties combining genes of resistance to downy and powdery mildew of different origins in the pursuit of stable and practically absolute resistance has been ongoing with the French National Institute for Agricultural Research (INRA) in Colmar. The first approvals from this programme are on the horizon for 2025.

Since 1996, 58 crosses have been made, creating more than 35 000 genotypes sorted using biomarkers and genotyping of resistance genes for Agroscope/INRA co-bred varieties.



This unique approach has led to the creation of two multi-resistant vine varieties: a red, Divico, in 2013; and a white, Divona, in 2018. Both of these have been welcomed with considerable interest for their ability to resist diseases and their high oenological potential.

Clonal selection

Varietal research is not only geared towards the selection of new vine varieties, but also towards the development of the genetic diversity present in traditionally cultivated varieties. Chasselas, for example, a variety that is an integral part of Swiss wine culture, has always been the object of special attention. Projects for the clonal selection of Chasselas began towards end of the 1940s and are still conducted today, seeking more quality-focused types of Chasselas with oenological profiles that are better adapted to climate change – concentrating on the acid content of the must, for example. Selection studies are also widely carried out for Pinot noir and Gamay. Since the 1990s, in partnership with the Swiss Office of Viticulture and the Society of Valais Nurseries, the majority of traditional, native vine varieties of this region have also been the object of a selection programme.

Up to now, a collection of over 1600 leading clones for 17 vine varieties has been established in Pully (canton of Vaud) and in Valais to represent the clonal variability of the varieties cultivated in Switzerland and preserve them in the long term. Pully therefore has the biggest collection in the world for Chasselas, with more than 300 different biotypes.

The most promising clones are evaluated accurately in agricultural and oenological terms, which makes it possible to approve and disseminate the most interesting through the Swiss certification system. Currently, 47 clones from 27 vine varieties and 2 rootstocks have been selected and disseminated to be planted over thousands of hectares in the Swiss vineyards. In 10 years from now, the 40 or so supplementary clones available will make it possible to offer a wide choice of the main traditional, native Swiss varieties, suitable for the highly diversified situations of Swiss vineyards.



42nd OIV World Congress

Early awareness among scientists, and also Swiss winegrowers, of the need to adopt the most environmentally friendly production methods still marks viticultural practices in Switzerland to this day. The objective is grape production that, in qualitative and quantitative terms, meets both production requirements and consumer expectations.

Switzerland is delighted to be hosting the 42nd OIV World Congress, for which the themes of discussion reflect the concerns of Swiss viticultural research in support of economically viable and environmentally friendly viticulture.



Agroscope CHANGINS, the Swiss federal centre of excellence for research in the agriculture and food sector



Divona, a multi-resistant variety bred by Agroscope.