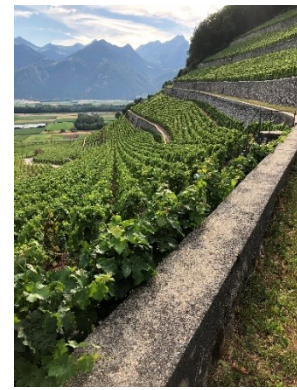


Challenges of heroic viticulture in Switzerland

Olivier Viret

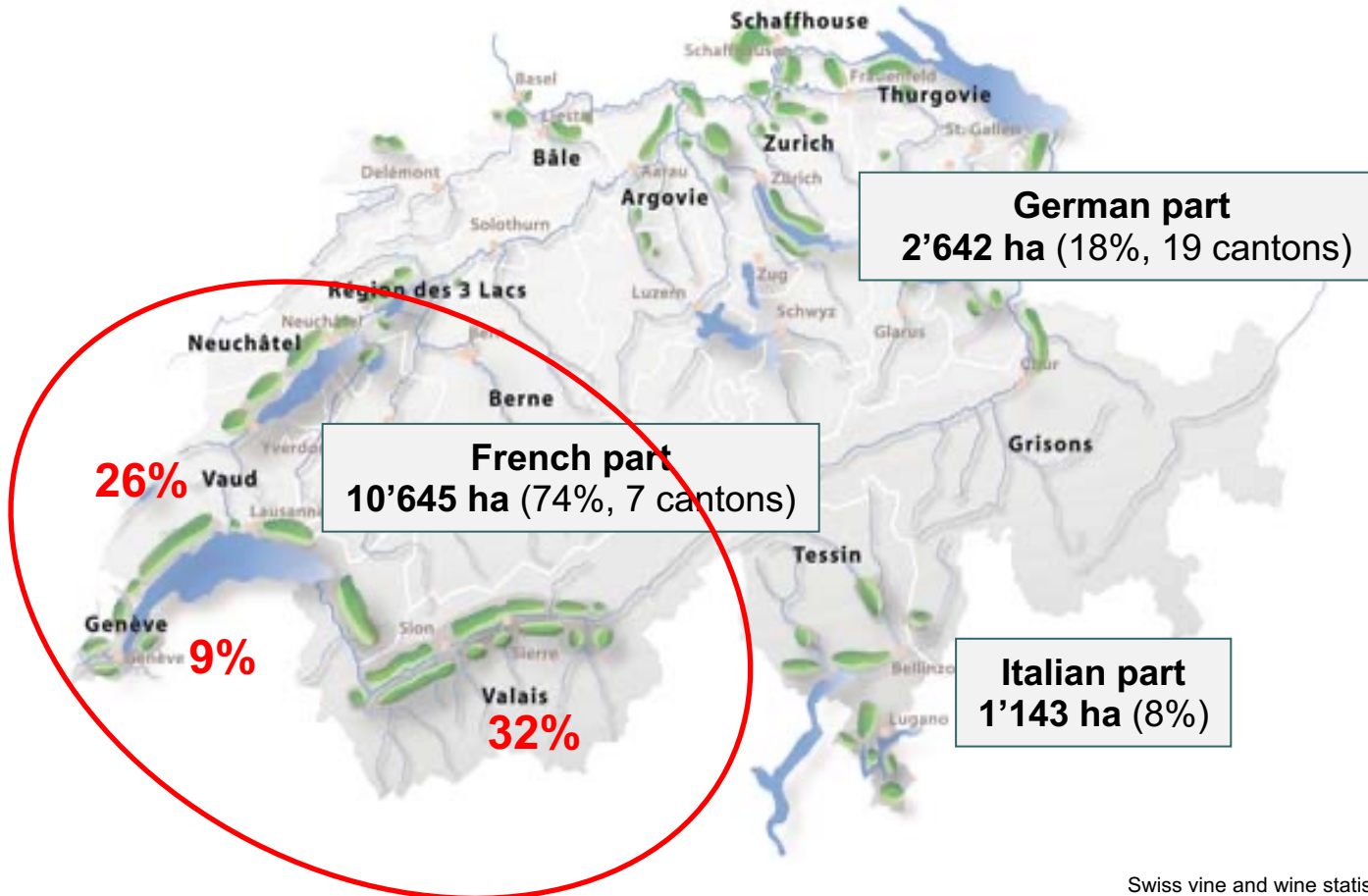
6 May 2026



Viticulture in Switzerland

2025: 14'430 ha (more and less stable, downward trend)

- 0.35% of Switzerland area
- 1.4% of the usable agricultural area
- **Estimated turnover: > 900 million SFr**



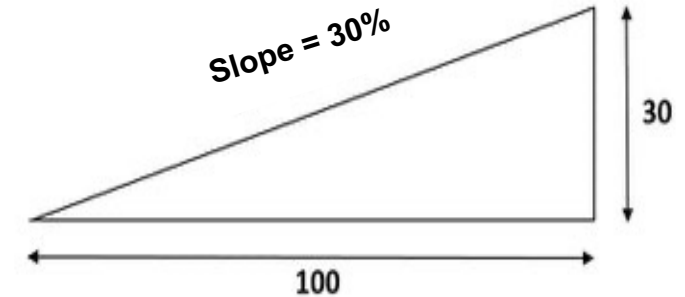
Swiss vine and wine statistics, 2025, OFAG, Berne

Heroic Swiss vineyards

About 40% of the Swiss growing area belong to heroic viticulture (26% after data of the agency for financial supports):

- slopes >30%
- terraces

Financial supports 2024	Data
Slopes 30-50%	1'697 ha
Slopes >50%	473 ha
Terraces	1'553 ha
Total	3'722 ha (26%)
Number of growers	2099
Surface per grower	1.77 ha
Mean amount per grower	5'587 SFr.
Total financial support	11.7 million SFs



Terraces and retaining walls

Lavaux (717 ha): ~ 450 km walls, 10'000 terraces, >90% of the area over 30% slopes



Terraces and retaining walls

Chablais (570 ha): ~ 370 km walls, >90% of the area over 30% slopes



Terraces and retaining walls

Valais (4'577 ha): ~ 3'000 km walls, >90% of the area >30% slopes



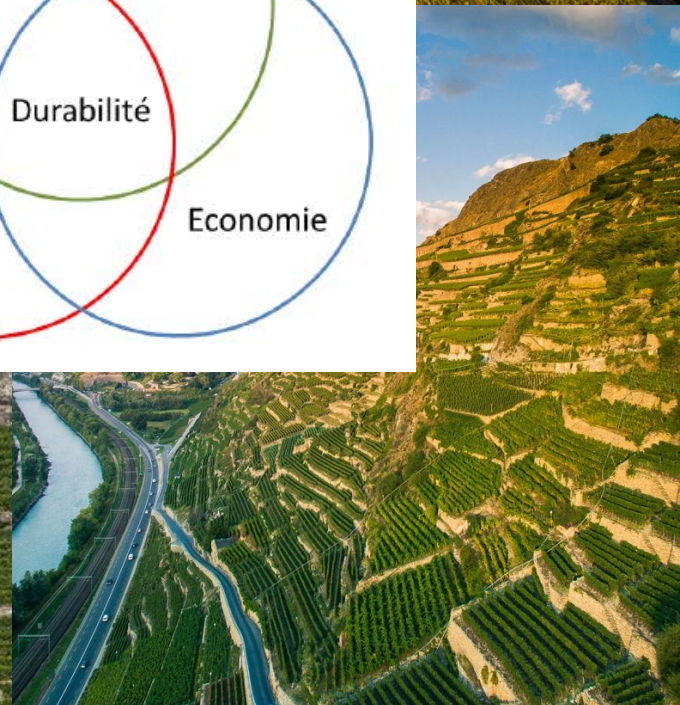
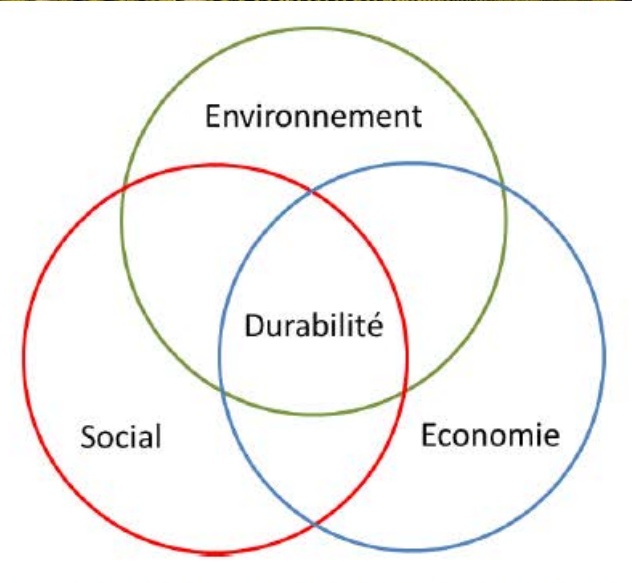
Challenges and opportunities for heroic viticulture in the heart of the Alps

- Alpine climatic conditions, complex production structures, high pressure of fungal diseases and pests...
- Open markets (since 1996) – competitiveness (yearly import quota of 170 million L)
- Production costs among the highest in the world
- Increased environmental awareness among the population (e.g. radical popular initiatives to ban plant protection products)
- Climate change...



Producing what competitors do not produce

Sustainability of heroic viticulture

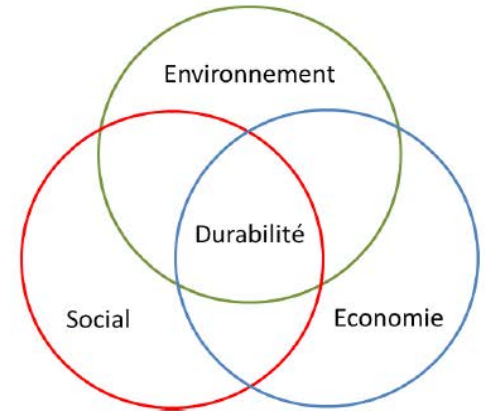


The three pillars of sustainability

Economy - Environment - Social

Resolutions of the OIV (CST 1-2004)

- Producing healthy, high-quality grapes
- Ensuring soil fertility and environmental quality in the long term
- Encouraging biological and biotechnological control methods
- Promoting ecologically and economically sustainable viticulture



Sustainable viticulture in Switzerland



1970 Concept of **integrated or sustainable production**
1977 Declaration of Ovronnaz (Valais, Switzerland) against indiscriminate use of chemicals

1993 Creation of VITISWISS
 National organisation for Integrated Production
 - Basic requirements
 - Additional requirements for the Vinatura Certificate

2014 Integrated and sustainable viticulture

2026 Sustainable Swiss Wine



The Evolution of Plant Protection Methods (IOBC 1977, modified)

1. Blind chemical control (Lutte chimique aveugle)	General, schematic and routine applications of the most potent pesticides; Advice from industry
2. Chemical control based on advice (Lutte chimique conseillée)	Application of usually broad spectrum pesticides after consultation with an official advisory service
3. Specific control (Lutte dirigée) <i>Transitory phase</i>	Introduction of the concept of the "economic threshold levels"; Application of pesticides with no negative side-effects; Protection of beneficial organisms
4. Integrated plant protection* (Protection intégrée) <i>Dynamic phase</i>	Like specific control, in addition Integration of biological and biotechnical methods and methods of good agricultural practice; Chemical control strongly regulated
5. Integrated agricultural production* (Production agricole intégrée) <i>Open dynamic phase, further development possible in the whole world</i>	Like integrated plant protection, in addition Observance, integration and exploitation of all positive factors in the agro-ecosystem according to ecological principles

Sustainable viticulture

Since 2013, financial support for sustainability in the Swiss Federal Constitution – financial support from the State Government



Required ecological services (PER)



Economical sustainability



Swiss wine market - market shares

Wine consumption in Switzerland: ~ 30 L / inhabitant / year
(worldwide 4th place)

2025 : 211 million L, of which 79.2 million L Swiss wines

Market parts of Swiss wines:

~ 35 - 38%

2023: 38.6% (+1.6%)

2024: 35% (-3.6%)

2025: 37.5% (+7.1%)

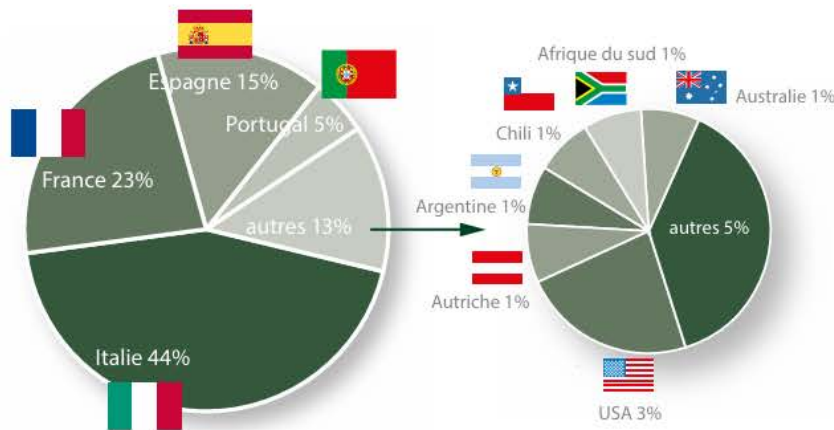


Figure 3-1: Importation par pays (total)



Swiss vine and wine statistics, 2025, OFAG, Berne

Production structures

~ 25'000 winegrowers

~ 2'500 cellars

20%

< 1 ha

54%

1 to 15 ha

7%

>50 ha

~ 10'000 part time winegrowers

Valais: 4'577 ha (2025), 1/3 of the CH vineyard area

~ 18'000 vineyard owners or growers

- >70'000 vine plots
- Average area per plot: 600-700 m²
- Average vine area per winegrower: ~ 2500 m²
- Winemakers: ~ 400



Production structures - Vaud

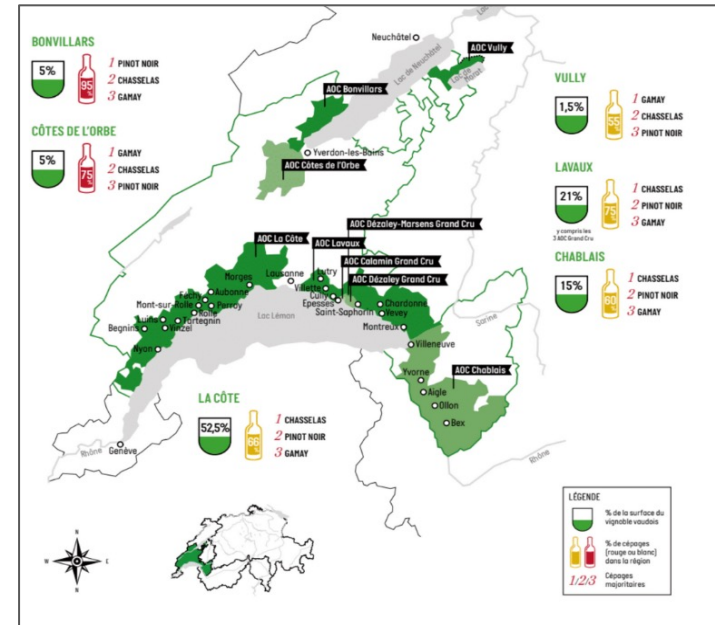
2025 (3'747 ha)

Vineyard

- 1'244 growers
- 13'400 vine plots
- 19'336 cultivar specific plots

Winemaking:

- 1 holding
- 9 cooperatives
(15'000 - 3.6 million L)
- 433 winemaking structures



Production ways

Integrated production

11'860 ha

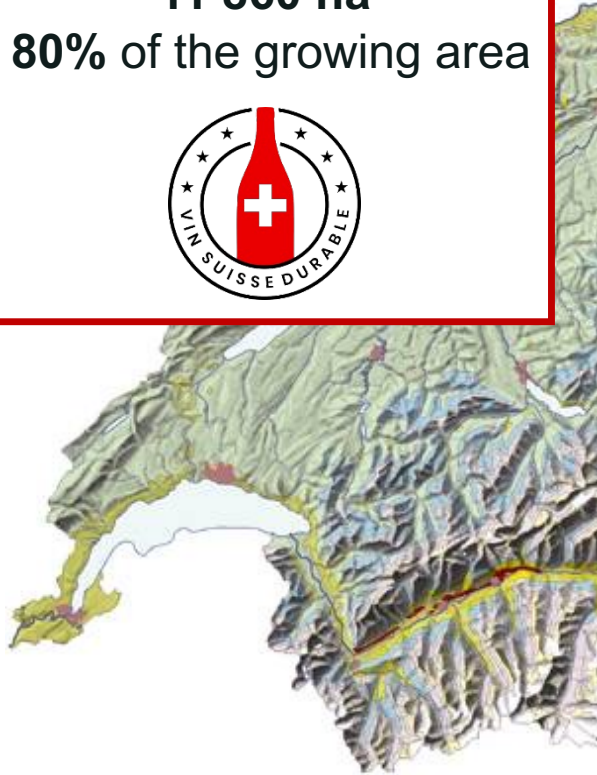
80% of the growing area



Organic and biodynamic production

2'818 ha

19.3% of the growing area



	2017	2019 (OIV)	2024
Switzerland	9.3%	12%	19.3%
France	7.7%	15%	21.5%
Italy	7.5%	14%	21.3%
Spain	8.3%	13%	16.1%
Germany	9.3%	8%	14%
Austria	12.5%	14%	24%
USA	2.7%	3.05%	?
Portugal	n.d	2%	?
South Africa	0.9%	0.95%	3.3%

Competition and production costs

Data 2023



Growing system	hours / ha	SFr. / ha
Non-mechanized "goblet"	1150	>65'000.-
High density cultivation with little mechanization	>900	>45'000.-
Terraces with little mechanization	>800	40'000.-
Terraces, tractor	745	38'000.-
Spur- or cane-pruned, highly mechanized	440	32'000.-
California, Australia, Chile, Argentina, South Africa...	100-200	5000 - 10'000



Source: Frais de production en viticulture, résultats technico-économiques 2023, Agridea

Competition and production costs



Competition and production costs



Swiss Biodiversity of grape

2025: 14'430 ha (>300 grape varieties, 90 varieties >1ha)

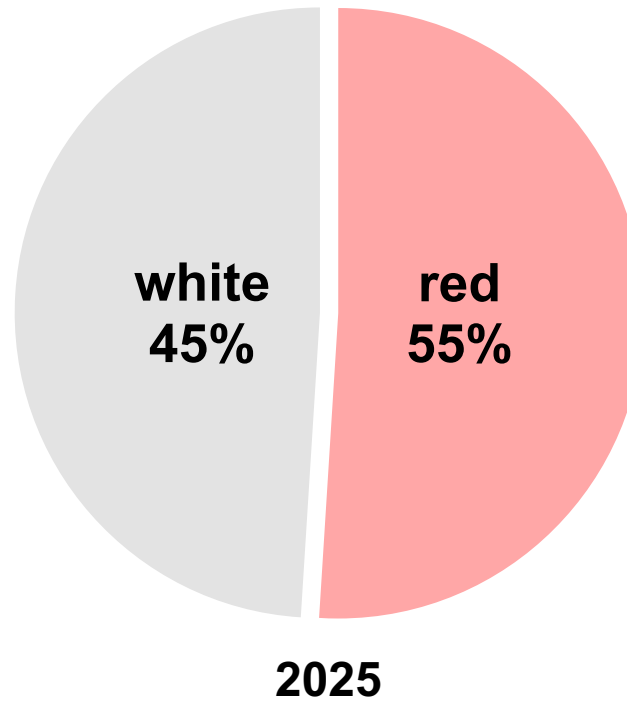
609 ha resistant varieties

<u>Chasselas (Gutedel)</u>	3415 ha	→
<u>Müller-Thurgau</u>	410 ha	→
Sylvaner (Johannisberg)		
Chardonnay		
Marsanne (Ermitage)		
Pinot gris		
Pinot blanc		
Sauvignon blanc		
Savagnin blanc (=Païen, Heida)		
Rèze		
Humagne blanc		
Petite Arvine		
Amigne		
Charmont		
Doral		
Divona (Gamaret x Bronner)	17 ha	→

<u>Pinot noir</u>	3594 ha	→
<u>Gamay</u>	1020 ha	→
<u>Merlot</u>	1190 ha	→
Cabernet franc		
Cabernet Sauvignon		
Syrah		
Bondola		
Humagne rouge		
Cornalin		
<u>Gamaret</u>	419 ha	→
Garanoir	219 ha	→
Diolinoir	124 ha	→
Carminoir (Pinot noir x Cab. Sauv.)		
Galotta (Ancellotta x Gamay)		
Mara		
Divico (Gamaret x Bronner)	108 ha	→
Merello (Merlot x Gamaret)		
Gamarello (Merlot x Gamaret)		
Cabernello (Cabernet franc x Gamaret)		
Cornarello (Humagne rouge x Gamaret)		
Nerolo (Nebbiolo x Gamaret)		

Source: année viticole 2024, OFAG, Berne

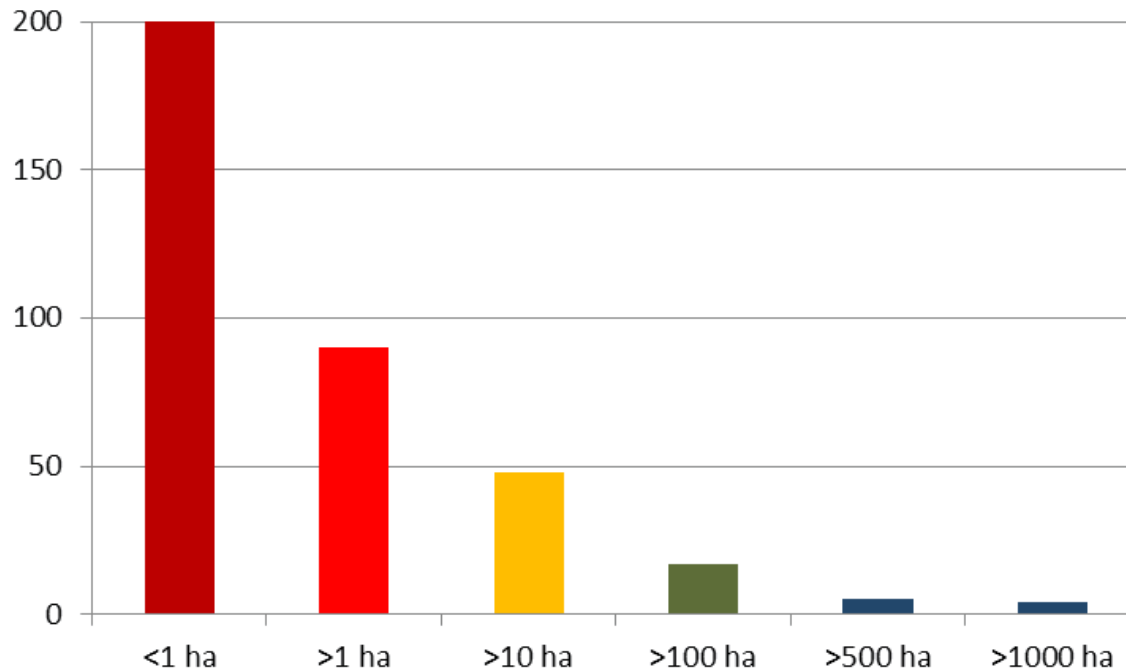
Biodiversity of grape varieties



Source: année viticole 2025, OFAG, Berne

Biodiversity of grape varieties

- <1 ha : 300 varieties
- >1 ha: >90 varieties
- >10 ha: 48 varieties
- >100 ha: 17 varieties
- >500 ha: 4 varieties (Pinot noir, Chasselas, Gamay, Merlot)
- >1000 ha: 4 varieties (Pinot noir, Chasselas, Gamay, Merlot)**
planted >70% of the Swiss vine-growing area



Sustainable diseases and pest management



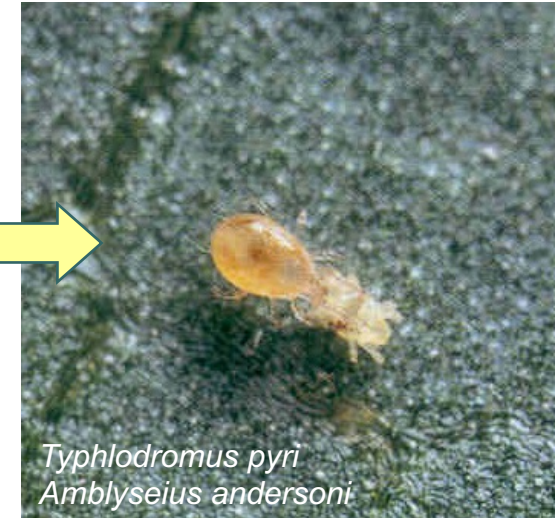
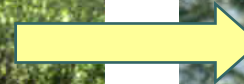
Control of mites



Tetranychus urticae



Panonychus ulmi



Typhlodromus pyri
Amblyseius andersoni

Time	Acaricides
1950 - 1975	16 active ingredients
2025	1 active ingredient
Reduction	- 94%



Absence of acaricides

Control of grape berry moths

Mating disruption



Lobesia botrana

Mating disruption
Synthetic pheromones



Eupoecilia ambiguella

85% of the vine-growing area

Insecticides

Time	Grape berry moths
1874 - 1995	53 active ingredients
2025	3 active ingredients
Reduction	- 95%



Herbicides

Challenge for organic viticulture = absence of any form of herbicide

Weed and invasive plants management: mechanical, thermal, weeding, mowing, etc.



Invasive plants:
e.g *Conyza canadensis*

Herbicides

Time	Herbicides
1983	28 active ingredients
2025	6 active ingredients of which 3 specific graminicides
Reduction	- 78 %



Fungal diseases



Plasmopara viticola



Vitis vinifera
Highly sensitive



Pseudopezicula tracheiphila



Phomopsis viticola



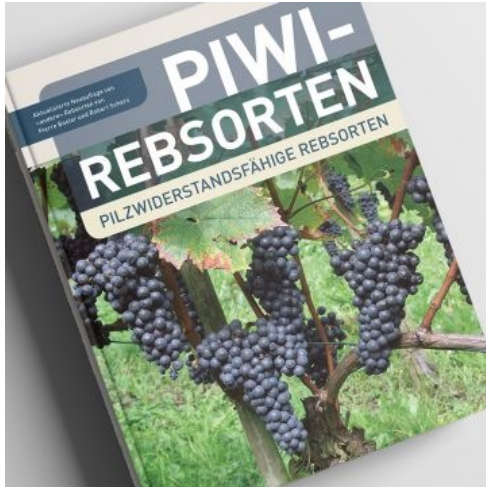
Guignardia bidwellii



Botrytis cinerea

Resistant varieties (*PIWI*)

Germany



Italy (*VCR, Rauscedo*)



Switzerland (Agroscope)

QTL: *Rpv1-Rpv3; Run1-Ren3*



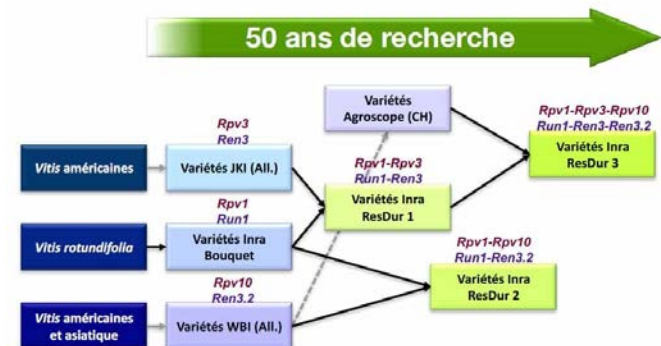
DIVICO (2013)



DIVONA (2018)

QTL: *Rpv10, RPV 3.3, Ren3, Ren9, Rgb1*

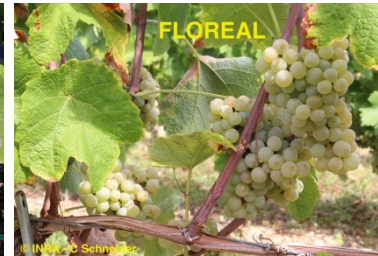
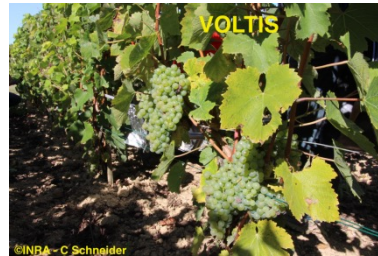
France (INRAe - ENTAV)
Breeding program RESDUR



Resistant varieties - France

INRAe-ENTAV 2018

RES DUR 1 (2018)



QTL: Rpv1, Rpv3; Run1, Ren3

RES DUR 2 (2023)



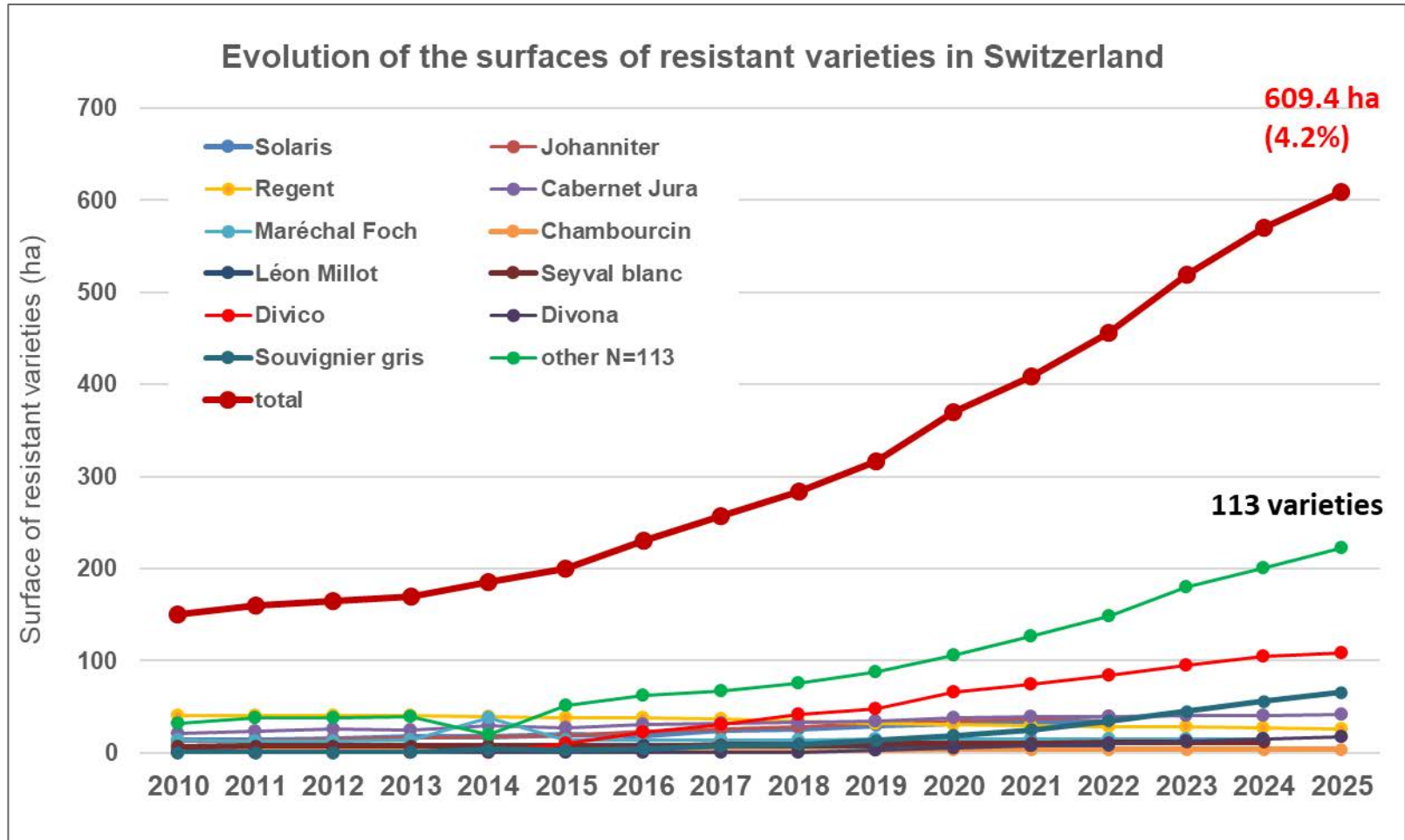
QTL: Rpv1, Rpv3.3, Rpv 10; Run1, Ren3, REN 9
partly Rgb 1, Rgb 3

RES DUR 3 (2025) INRA – Agroscope (CH)



QTL: Rpv1, Rpv 3.1, Rpv3.3, Rpv 10; Run1, Ren3, REN 9
partly Rgb 1, Rgb 3

Evolution of the surfaces of resistant varieties in Switzerland (2010-2025)



Conclusions

- The main challenge for heroic viticulture: its economic sustainability – depending on financial supports by the State
- Winegrowers and consumers should be proud of local products
- Wine: a cultural asset, an identity, a source of pleasure and sociability
- Recognition of the ecosystemic values of heroic mountain viticulture
- Evolution towards non-alcoholic attractive beverages based on grapes
- **The market evolves fast with demands that regulated perennial crops cannot follow with the same dynamics**

The future of sustainable heroic viticulture in Switzerland

➔ MARKETING, ENOTOURISM, UNIQUE PRODUCTS ALSO WITHOUT ALCOOL, LANDSCAPE, ALTERNATIVE CROPS IN DIFFICULT SITES

➔ MANAGEMENT OF FUNGAL DISEASES, NEW PESTS AND DISORDERS, WEED CONTROL

➔ VARIETIES BETWEEN TRADITION AND INNOVATION REDUCING PRODUCTION COSTS AND ADAPTED TO CLIMATE CHANGE

A new compendium of fungi in grapevine by Olivier Viret and Katia Gindro (Swiss researchers and experts in viticulture pathology)

Olivier Viret · Katia Gindro *Editors*
Science of Fungi in Grapevine

This open access book provides a comprehensive exploration of the relationship between fungi and grapevines, covering contemporary mycological classifications, pathogens, the microbiome, endophytes, and mycorrhizae. Inspired by the French book "La Vigne, Maladies Fongiques" by the same authors, which won first prize at the 2015 OIV book competition (Organisation Internationale de la Vigne et du Vin, Dijon), this work aims to extend and update that foundational text.

The introduction delves into the origins and adaptability of grapevines in response to evolving fungal diseases, alongside an overview of their biology, epidemiology, and control measures. The second chapter covers the systematics of the genus *Vitis*, the developmental stages of the vine, the anatomy of various organs, the history and breeding of resistant varieties, and the natural defense mechanisms of grapevines against fungal infections.

A significant portion of the book provides the latest insights into mycology, including chapters on fungal systematics and taxonomy, as well as the concepts of holobiome, microbiome, and mycobiome in relation to grapevines. The third part focuses on fungal diseases affecting green organs, wood, and roots, illustrated at macroscopic, microscopic, and ultrastructural levels, and includes discussions on disease cycles and epidemiology. Additionally, there is a chapter dedicated to grafting systems and the specificity of fungi in nurseries.

The final chapter addresses the control of fungal diseases, from historical perspectives to modern chemical groups of active ingredients, natural fungicides, and comprehensive disease management strategies. This includes application techniques, calibration of spraying equipment, drift reduction, and proper storage and handling of fungicides.

This open access book serves as a key reference on the complex interactions between fungi and grapevines for scientists, students, and winegrowers, offering extensive practical knowledge and a rich scientific background based on over thirteen years of research by the authors.

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Viret · Gindro *Eds.*



Science of Fungi in Grapevine

Olivier Viret
Katia Gindro
Editors

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Lavaux and “Fête des vigneronns” UNESCO World Heritage