 Département fédéral de l'économie,
de la formation et de la recherche DEFR
Agroscope

Varietal innovation for sustainable viticulture


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6 èmes rencontres suisses de l'oenotourisme
Lausanne, 2023.10.26

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 **The « lost paradise »**

- In the 1850s, powdery mildew (*Erysiphe necator*) was introduced into Europe from the USA.
- In the 1870s, downy mildew (*Plasmopara viticola*) was introduced in Europe from the USA.
- Traditional European grape varieties are sensitive to these fungal diseases and must be regularly treated with fungicides in order to preserve the harvest and its quality.
- Fighting against these diseases is independent from the mode of production (organic, integrated...)

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 **Grey rot (*Botrytis cinerea*)**



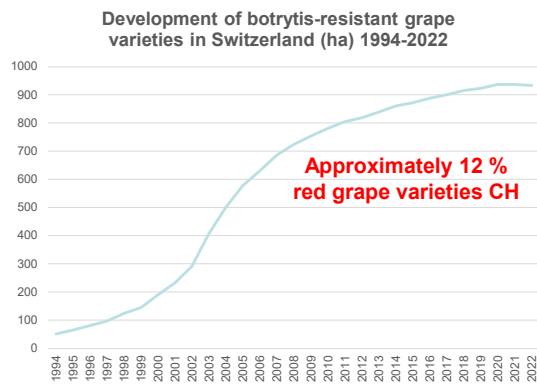
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 **Agroscope breeding program**

1) **1965-2016:** Creation of red grape varieties with resistance to grey rot (*Botrytis cinerea*). Classical crossings between *V. vinifera* grape varieties.



GAMARET
GAMAY

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🇨🇭 Powdery mildew (*Erysiphe necator*)



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🇨🇭 Downy mildew (*Plasmopara viticola*)



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Reduction of phytosanitary inputs

- Fighting against downy and powdery mildews generally requires 6-10 applications of fungicides, whatever the production system (integrated, organic), on conventional European varieties (nearly 97% of the vineyard area).
- On average, fungicides account for 80% of phytosanitary inputs used in viticulture.

Opportunities to reduce fungicide use	Impact
1. Agrometeo, risk forecasting	0 - 30%
2. Appropriate dosage	0 - 30%
3. Resistant grape varieties	75-90%

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V. rupestris *V. aestivalis* *V. amurensis* *V. piasezkii*

V. rotundifolia *V. romaneti* *V. vinifera*

Wild *Vitis* species from America or Asia are resistant to downy and powdery mildew

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Wild vines are interfertile with cultivated vines (*Vitis vinifera*)

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Sexual reproduction allows recombination of parental characters

Wild species

- ✓ Resistant to one or more disease
- ✗ Defects agronomical and oenological

X

Cultivated varieties

- ✓ Quality et typicality
- ✗ Sensitive toward diseases

New resistant varieties

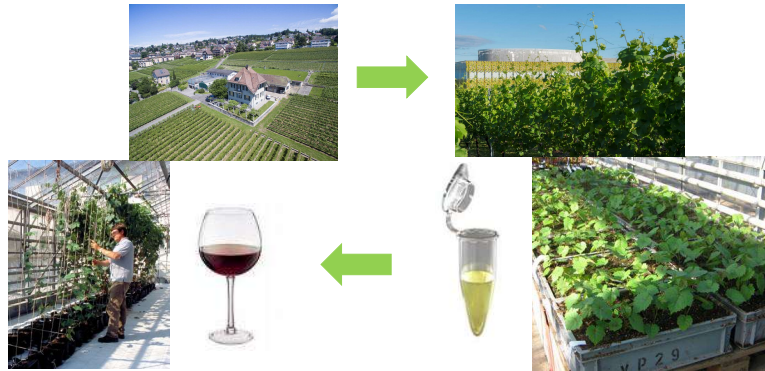
- ✓ Possessing **sustainable resistance** to downy and powdery mildew
- ✓ **Agronomical and oenological** skills adaptated to viticulture in a context of global warming

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Agroscope selection program

2) 1996-2018: creation of varieties resistant to downy (*Plasmopara viticola*), powdery (*Erysiphe necator*) mildew and grey rot (*Botrytis cinerea*) with a low sensitivity to black rot (*Guignardia bidwellii*).



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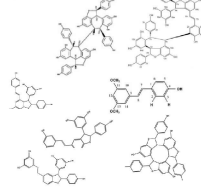
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Agroscope selection program

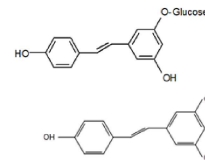
Conventional interspecific crosses using biochemical markers of resistance.

- Identification of fungicidal molecules
- Early selection of candidates

Viniferin, Pterostilben...



Piceide, Resveratrol...



resistant

sensitive

Divona Divico...

Gamay Chasselas...

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Divico first resistant red grape variety from Agroscope (2013)

- ✓ High resistance against downy mildew, medium to high against powdery mildew and very high against gray rot. Low sensitivity against black-rot (1-3 phyto treatments/year depending on disease pressure)
- ✓ Carries resistance factors Rpv10 and Rpv3 (downy mildew); REN3 et REN9 (powdery mildew); RGB1 (black-rot)
- ✓ Precocity close to that of Pinot noir. Medium to high production potential
- ✓ High qualitative potential. Very colourful, structured wines, rich in polyphenols.
- ✓ Typical aromas: fruity (black cherry) and spicy notes



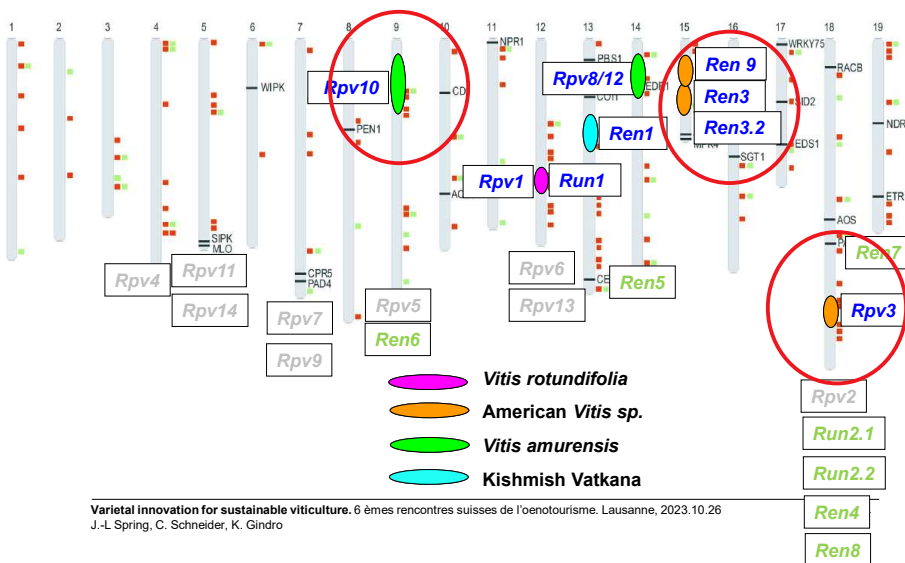
Divico (Gamaret x Bronner)

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Resistance factors to downy and powdery mildew of Divico and Divona



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Divico – already a success story ?



Le Divico, héros des caves
LA SUISSE PEUT ÊTRE HÉROÏNE. LA STATION DE RECHERCHE DE CHAMONIX EST AU CŒUR DE DU PREMIER CÉPAGE DU MONDE. NE NÉCESSITANT AUCUN TRAITEMENT PHYTOSANITAIRE ET APTE À DONNER DU BON VIN.

ZOOM Robusta, vin et central. Vinos italiani la scoperta, le migliori. Fochi, quel è il fiore.

Le divico nouveau arrive... DEGUSTATION Le dernier né de l'Agroscope débarque en terres valaisannes. Il se divise à des états que ses producteurs convoitent.



Der verwegene Rote vom Neuenburgersee
Louis-Philippe Burgat ist mit der Sorte Divico ein überzeugender Wein gelungen.



8 RÉGION
WIGNONBLE Un nouveau cépage fait ses preuves à la Station viticole cantonale.
Le divico se fait sa place au soleil
Le divico va révolutionner pas mal de choses...
Après cette dégustation, et pour être sûr d'être sûr, il faut aller à la source. C'est à la Station viticole cantonale, dans le Valais, que se trouve le laboratoire de recherche et de développement de ce cépage. C'est là que les producteurs valaisans ont pu tester le divico sur leurs parcelles. C'est là que les producteurs valaisans ont pu tester le divico sur leurs parcelles. C'est là que les producteurs valaisans ont pu tester le divico sur leurs parcelles.

Economie 41
Les viticulteurs sont fous du divico
Vins résistants aux maladies, prometteurs pour le palais, écologiques, économiques, le nouveau cépage romand, encore à l'essai, tient toutes ses promesses.

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Divico – already a success story ?



Concours PIWI International 2020
(413 wines, 15 countries, 62 wines CH)

- Red grape varieties:
- 2 Divico grand or (best competition score 98/100)
 - 7 gold and grand gold medals

Grand prix du vin suisse 2020

- 1 Divico gold medal

Concours PIWI International 2021
(432 wines, 16 countries, 62 wines CH)

- Red grape varieties:
- 1 Divico grand gold
 - 6 gold medals (scores of 90-96)



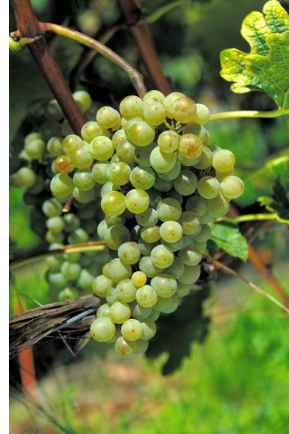
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Divona first white resistant variety from Agroscope (2018)

- ✓ High resistance against downy mildew, medium to high against powdery mildew and good resistance against gray rot. Low sensitivity against black rot. (1-3 phyto treatments/year depending on disease pressure)
- ✓ Carries resistance factors RPV10 and RPV3 (downy mildew), REN3 and REN9 (powdery mildew), RGB1 (black-rot)
- ✓ Early ripening (like Müller Thurgau). High production potential
- ✓ High qualitative potential
- ✓ Aromatic wines (citrus, exotic notes) with a good structure



Divona (Bronner x Gamaret)

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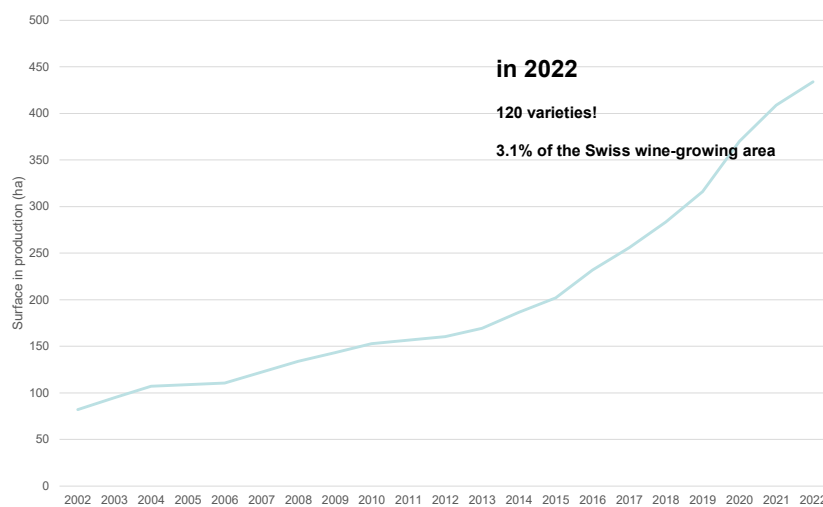
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Development of resistant grape varieties in Switzerland 2002-2022 in ha (source: OFAG)

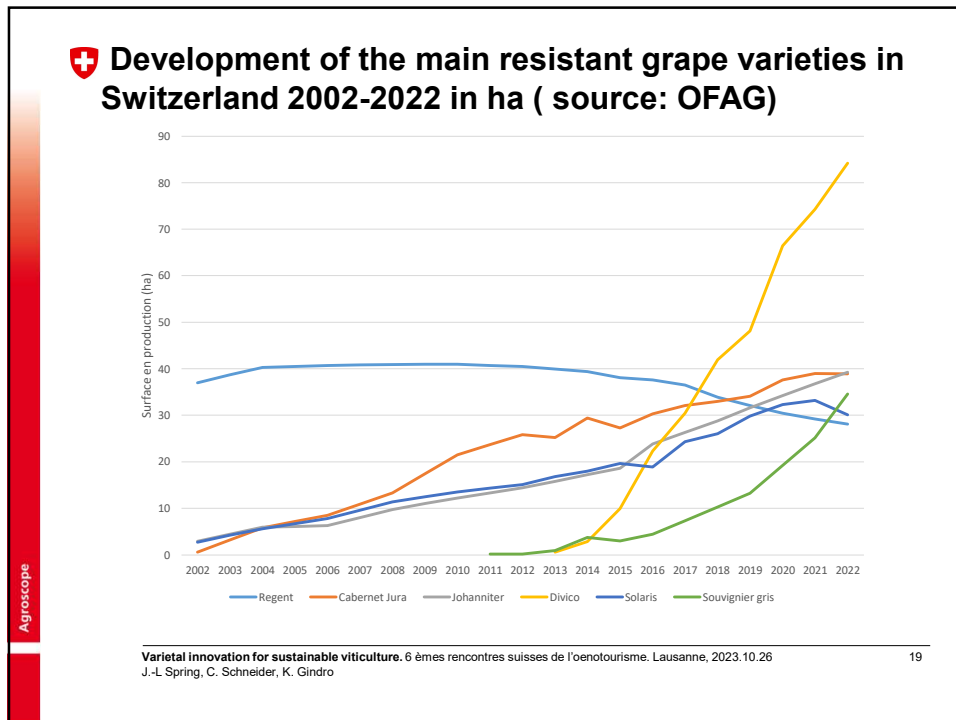


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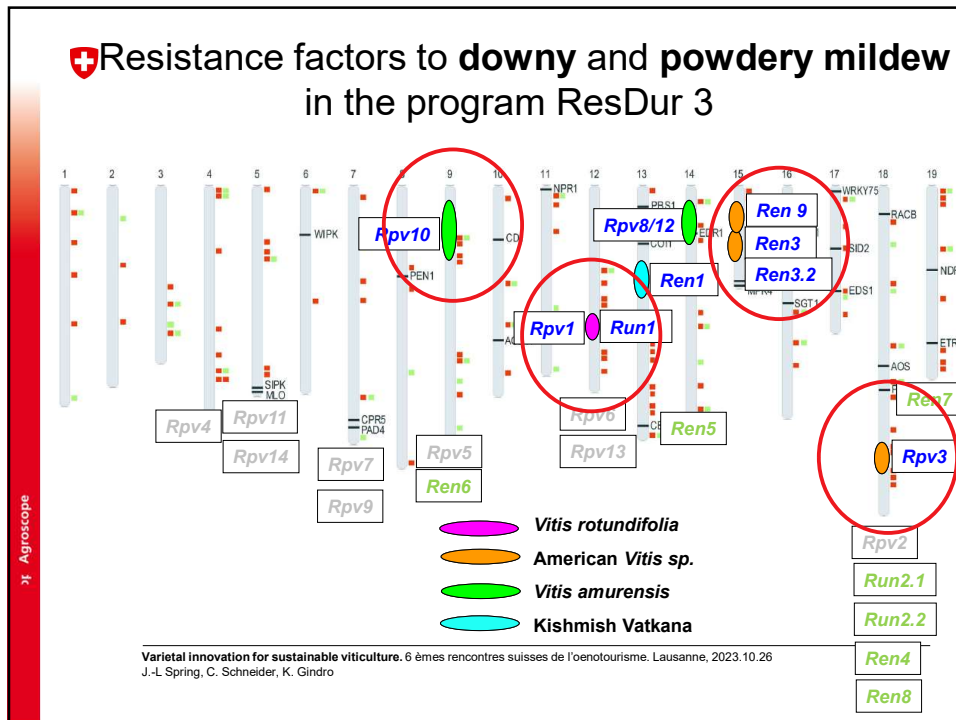
Agroscope/INRAE selection program

3) 2009-2033.....: Selection of resistant grape varieties with pyramiding resistance genes against downy (*Plasmopara viticola*) and powdery mildew (*Erysiphe necator*). Resistance to gray rot (*Botrytis cinerea*) and low sensitivity against black rot (*Guignardia bidwellii*).

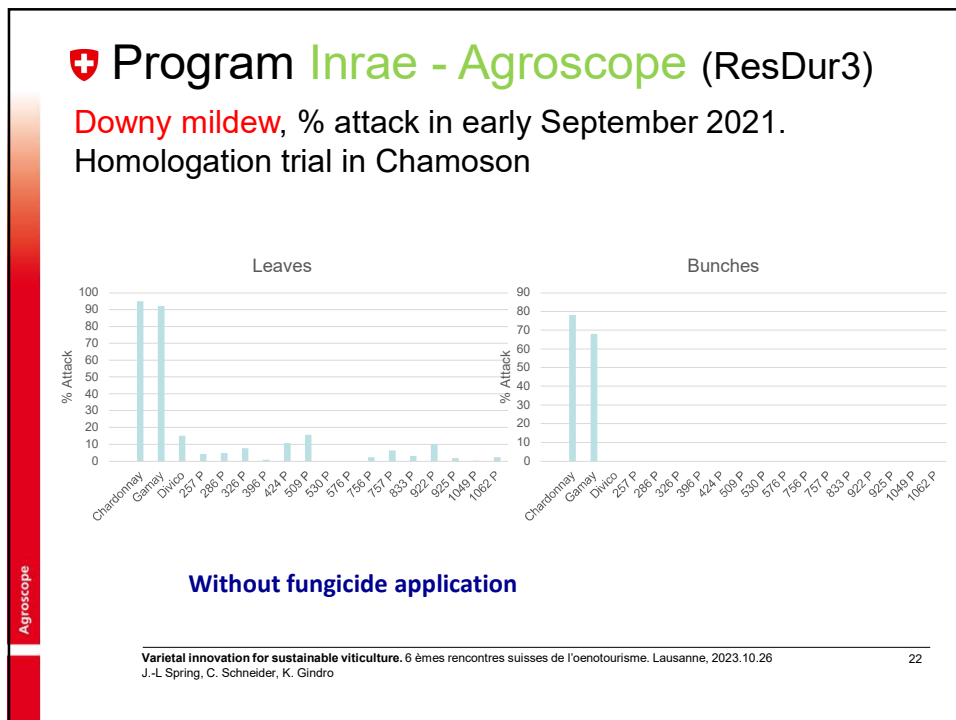
Collaboration with INRAE-Colmar (co-obtainment). Program ResDur3

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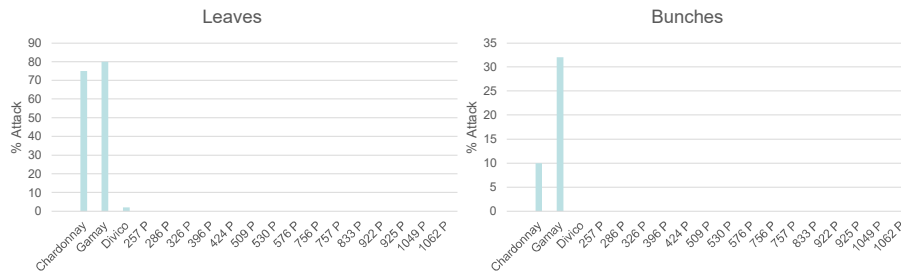


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Program Inrae - Agroscope (ResDur3)

Powdery mildew, % attack in early September 2021
Homologation trial in Chamoson



Without fungicide application

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Conclusions

- **Selection of grape varieties resistant to *Botrytis* since 1965 at Agroscope**
Marketing since 1993
(12% of the red grape growing area in Switzerland, 933 ha in 2022)
- **Selection of disease resistant varieties with the use of biochemical markers**
1 red grape variety, **Divico**, released in 2013
(resistant variety most cultivated in Switzerland with 84 ha in 2022)
1 white grape variety, **Divona**, released in 2018 (11ha in 2022)
- **Currently : selection of resistant grape varieties with gene pyramiding (level and stability of resistance). Program ResDur 3.**
Collaboration with INRAE-Colmar
First varieties released in 2024-2025 (3-5 varieties)
30 other candidates in the homologation process (2022, 2024)
- **New projects «Resistant Chasselas», «Resistant Arvine»**
Agroscope/INRAE/Canton VD collaboration, 2018-2033/Canton VS, 2023-2037

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Thank you for your attention

Program partners:



Christophe Schneider

Equipe Génétique et
Amélioration de la Vigne

Unité Expérimentale de Colmar

 Agroscope

Jean-Laurent Spring

Groupes de recherche
Viticulture, Oenologie,
Analyses et Mycologie



Selection partners



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