



Schweizerische Eidgenossenschaft
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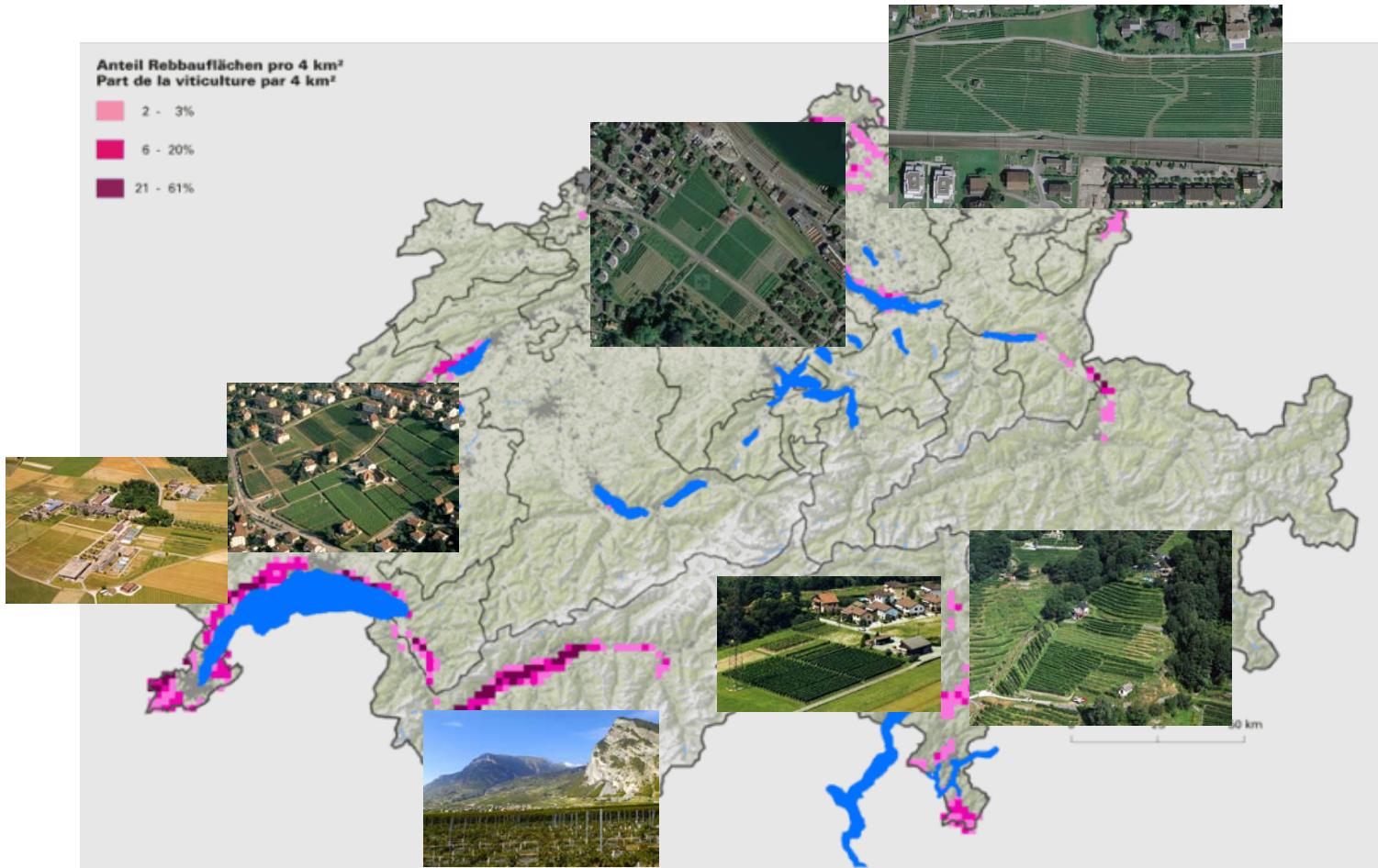
Département fédéral de l'économie DFE
Station de recherche Agroscope Changins-Wädenswil ACW

REDUCED USE OF INPUTS THROUGH PRECISION VITICULTURE

Olivier Viret



Agroscope research centers in viticulture





Research in viticulture – enology

- 7 experimental sites (>3000 unitary plots)
- 2 experimental cellars: Changins ~200 vinifications
Wädenswil ~100 vinifications
- 1 micro-vinification unit: Pully ~200 micro-vinifications (<20 l)
- 1 analytical laboratory Changins: 40'000 determinations
8'000 samples
- 8 research groups: 4 in viticulture – enology (27 collaborators)
4 in plant protection (43 collaborators)





Strategies of Agroscope to reduce inputs in viticulture



Reduced use of inputs through precision viticulture / Lien de la vigne, Paris
Olivier Viret, Katia Gindro, J-P. Mayor



Strategies

Integrated production (concept developed since 1970 in Switzerland)

1. Disease forecasting - Agrometeo
2. Crop adapted dosage of plant protection products
3. Breeding resistant cultivars
4. New active ingredients in plant protection



Integrated production



Entomology:

- Biological control of mites

Result: absence of acaricides



Tetranychus urticae



Panonychus ulmi



- Sexual confusion against grape berry moths
Result: more than 60% of the growing area without insecticides





Integrated production

Fungal diseases



Plasmopara viticola



Erysiphe necator



Pseudopezicula tracheiphila



Phomopsis viticola



Guignardia bidwellii



Botrytis cinerea



Integrated production



Control of fungal diseases

- Control of fungal disease: inevitable to produce quality grape
- Average number of sprays in Europe: 10-12 fungicides
- Weak acceptance at the ecological, political and societal, as well as at the economical level





Integrated production

Control of fungal diseases



Objective: **ecologically and economically sustainable production of grape**

→ Reduction of inputs and high quality grapes and wines

(France: “Grenelle de l'environnement” 50% reduction of the uses of pesticides)

Worldwide: >95% of the growing area planted with sensitive *Vitis vinifera*

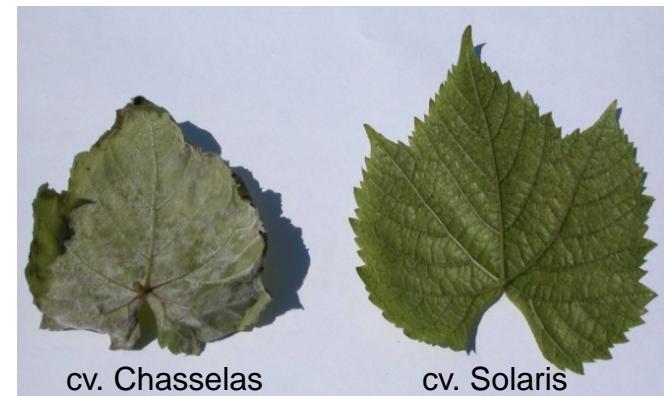
1. Precise use of fungicides:

- Forecasting models
- Leaf area adapted dosage
- Choice of active ingredients
- Calibration of the sprayers



2. Elicitors,
antagonists,
natural products

3. Breeding of resistant
varieties





Success of the disease control

Forecasting models



Right time

Right dosage

Right
product

Right deposit

List of products(since 1996)

Leaf area adapted dosage

	A-C (0-0)	D	E (11-13)	F (1)	G (2)	H (25)	I (18-49)	J (71-75)	L	M (91)
JET PROJETE LANCE-GUN		PAS APPROFIE	1000	1200	1.5 kgha	1800	2000	2 kgha		PAS APPROFIE
			1 kgha	1.2 kgha	1.5 kgha	1.8 kgha	2 kgha			
JET PROJETE RAMPES, PENDILLARD, BOLLE A DOG		800	600	800	1000	1200	1600	1200		
		0.8 kgha	0.6 kgha	0.8 kgha	1 kgha	1.2 kgha	1.6 kgha	1.2 kgha		
BASE DE CALCUL										
JET PROJETE ET PRESSION TOUTES DIFFUSEURS, ATOMISEUR, ANGLAIS, ETC.		PAS APPROFIE	150	200	250	300	400	400	300	
			0.6 kgha	0.8 kgha	1 kgha	1.2 kgha	1.6 kgha	1.2 kgha		

► Sprayers calibration

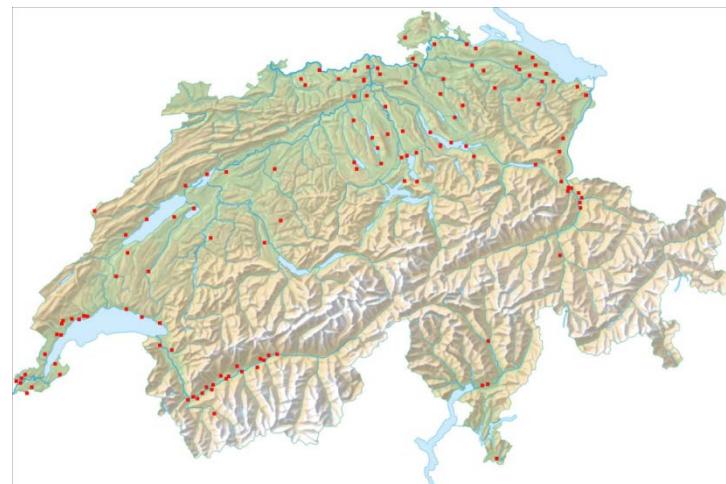




1. Disease forecasting Agrometeo



- VitiMeteo: downy and powdery mildew forecasting (>150'000 ha in Europe: D, I, A, CH)
- Model developed by Agroscope and research institute of Freiburg (Germany)
- Allows a precise spraying schedule
- Agrometeo: 153 weather stations over the whole country





Forecasting of diseases

Free Internet access: www.agrometeo.ch



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Bienvenue sur  Agrometeo

Choisissez votre région

The map shows the topographical features of Switzerland with three regions highlighted: "Suisse alémanique" in the north, "Suisse romande" in the west, and "Tessin" in the south-east.

Deutsch

Visites: 350949

Administration fédérale admin.ch

AGROMETEO Prévision et gestion des risques pour l'agriculture / Agroscope

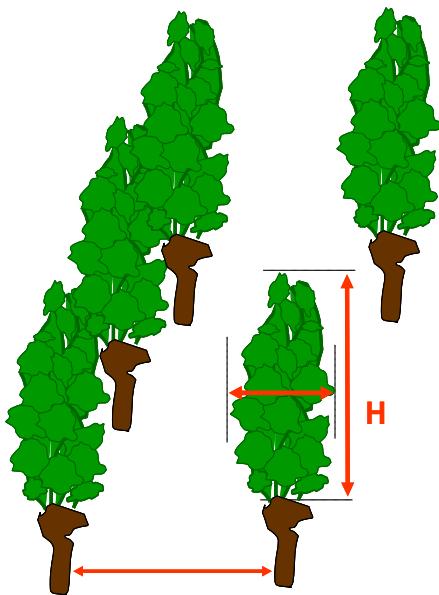
Partenaires:

- Ryser Solutions Informatiques
- Service de l'agriculture Genève
- Station d'agroécologie Valais
- Service de l'agriculture Vaud
- Ecole d'ingénieurs de Changins
- FIBL
- Weinbauinstitut Freiburg DE
- Geosens
- Meteoblue



2. Crop adapted dosage

- Dosages vary depending on plant densities (row distances, developmental stages, etc...)
- Objective: precise use of active ingredients, adapted to the leaf area (VRV = Vine Row Volume m³/ha)



$$\frac{\text{hauteur (H)} \times \text{largeur maximale (L)} \times 10\,000 \text{ m}^2}{\text{distance interligne (D)}} = \text{volume foliaire (m}^3/\text{ha})$$

Exemple: $\frac{1.4 \text{ m} \times 0.5 \text{ m} \times 10\,000 \text{ m}^2}{2 \text{ m}} = 3500 \text{ m}^3 / \text{ha}$



Adapted dosage in www.agrometeo.ch



Accueil
Concept
Modélisations
Liens
Contacts

31.05.2010 : La station de Biasca est hors service pour une période indéterminée (cause : foudre).

Enquête de satisfaction

Suisse romande et Tessin

Suisse alémanique

Deutsch

Visites: 233801

Dosage des fongicides en fonction du volume foliaire de la vigne



Cette routine permet de calculer rapidement la quantité de fongicide à appliquer en fonction de la surface foliaire à traiter en indiquant la hauteur, la largeur du feuillage et la distance interligne, ainsi que la concentration homologuée du produit. Cette méthode est décrite dans la Revue suisse de Vitic. Arboric Hortic. 37(1):59-62. Elle ne s'applique qu'aux vignes palissées sur fil de fer et qu'avec des appareils de traitement parfaitement calibrés et adaptés à la culture.

Recalculer

[Imprimer](#)

0.156 kg ou L/ha
(5500 m² >> 0.086 kg ou L)

0.779 kg ou L/ha
(5500 m² >> 0.428 kg ou L)

Produit 1
Concentration (%)
ou Quantité (kg, l/ha)

Produit 2
Concentration (%)
ou Quantité (kg, l/ha)

Produit 3
Concentration (%)
ou Quantité (kg, l/ha)

Feuillage: 2250 m³/ha

Since 2006: label on products indicates the dosage for a leaf volume of 4'500 m³/ha



3. Breeding of resistant cultivars

- Traditional cultivars (*Vitis vinifera*) are highly sensitive to fungal diseases
- Use of resistance genes from other *Vitaceae*
- Classical crossings and selection based on metabolites (phytoalexins, callose) and sporangia density





Agroscope breeding for Botrytis resistance

Cross-breeding of *V. vinifera*



Gamaret

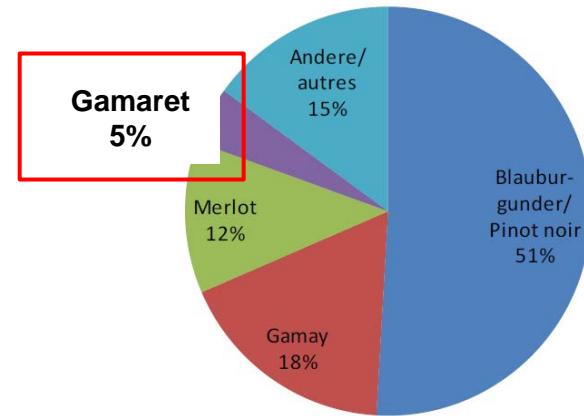


Garanoir



Mara

Gamay x Reichensteiner



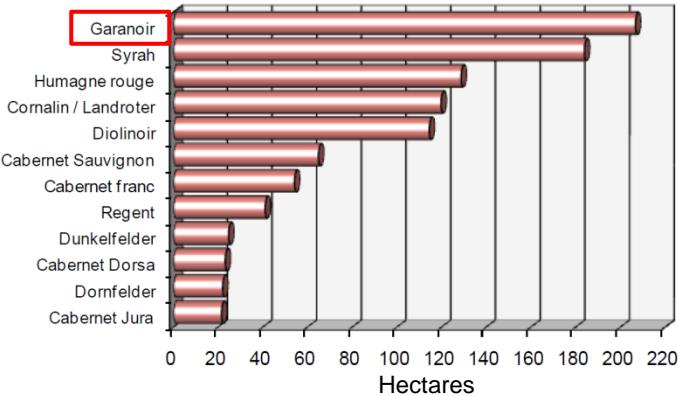
Galotta

Ancelotta x
Gamay



Carminoir

Pinot noir x
Cabernet Sauvignon





Breeding cultivars resistant to downy, powdery mildews and Botrytis

- High resistance to downy mildew
- Weak sensitivity to powdery mildew and Botrytis
- Priority to red early ripening varieties
- High quality wines in the line of the local references and good agronomical characteristics





Breeding resistant cultivars

Since 1996

- 55 different crosses
- 896 retained individuals after downy mildew tests (phytoalexins profile) and field observation
- 33 cultivars (30 red, 3 white) at the 20 plants level.
First wines in 2004
- 13 cultivars in larger experimental plots
- 1 cultivar (Divico) registered after DHS-test
- Distribution of certified basis material





4. New fungicide molecules alexins: biocides and elicitors

- Alexins: molecules (secondary metabolites) synthetized after stress and acting as antimicrobial compounds

*Phyto*alexins



*Myco*alexins





Alexins: new fungicide molecules ?

- In **plants**: natural defense molecules against fungi
Example: grapevine produce stilbens = resveratrol and derived molecules highly toxic against main grapevine fungal diseases
- In **fungi**: defense molecules of a fungus against another fungus (chemical war !)





Alexins: new fungicide molecules ?

Aims of ongoing researches:

- Induction of alexins under controlled conditions to use chemical war between fungi
- Discover new chemical structures and active ingredients
- Evaluate the effectiveness of those molecules as fungicides for plants and human health (onychomycosis by Fusarium, aspergillosis, helminthosporiosis, candidosis...)





Alexins: new fungicide molecules ?

Long term objectives:

- Development and registration of new active ingredients from naturally occurring unexploited resources for a sustainable and ecological viticulture, as well as to control human fungal pathogens where no more fungicides works (resistance)





Reduced use of inputs ?

Strategies	Impact	Number of treatments (N=12)
1. Integrated production	10 - 30%	- 3 à 4
2. Agrometeo, disease forecasting	10 - 30%	- 1 à 4
3. Crop adapted dosage	20 - 30%	0
4. Resistant cultivars	75 – 100 %	- 8 à 12
5. Alexins (biocide, elicitor)	0%	0



Thank you for your attention



... and welcome to enjoy Swiss wines

