Diseases resistant vines : towards the vineyards of the future

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Downy & powdery mildews

- French vineyards account for **20% of total plant protection products** (PPP) annual uses while covering 3% of arable lands
- Fight against downy and powdery mildews represent an average of **12 fungicide treatments** per year
- Costs of about € 300 million / year
- Additional costs due to negative side effects (health, environment, …)

Downy & powdery mildews

Chardonnay

With treatment

Without treatment

Resistant variety

Without treatment

Our strategy : sustainable management of varietal resistance

V. rupestris *V. lincecumii*

M. rotundifolia

V. vinifera

V. amurensis

⇒ Vitis species from Amercica and Asia are naturallly resistant to mildew

Our strategy - sustainable management of varietal resistance

- A **limited number** of resistance genes in the natural diversity
- Resistance genes **can be overcome** by fungi : they are breakable
- Resistance genes are a **common good** => rational use

Resistance genetic factors to	Described	Used in varieties	Already overcame
Downy mildew	21	4	1
Powdery mildew	12	3	1

➢ **Our strategy : to build several defense lines by cumulating resistance genes in the same variety => pyramiding**

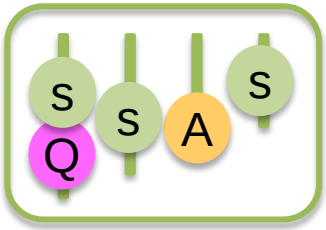
Our strategy - sustainable management of varietal resistance

Presently grown varieties

✓ Quality and typicity

✗ Diseases susceptibility

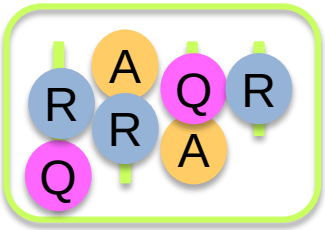
50 years



Brand new bred varieties

✓ Sustainable resistance to mildew

✓ **Growing and wines qualities**



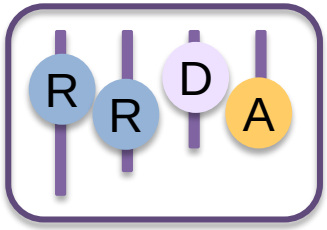
Wild species

✓ Disease resistances

✗ Cropping and wine defects

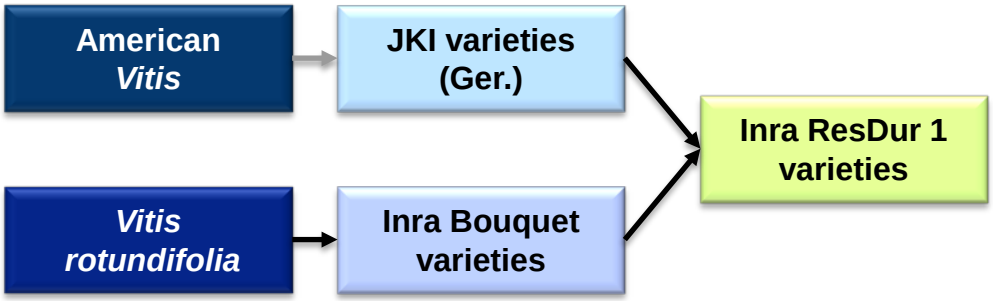
x → … →

50% Vv 99% Vv



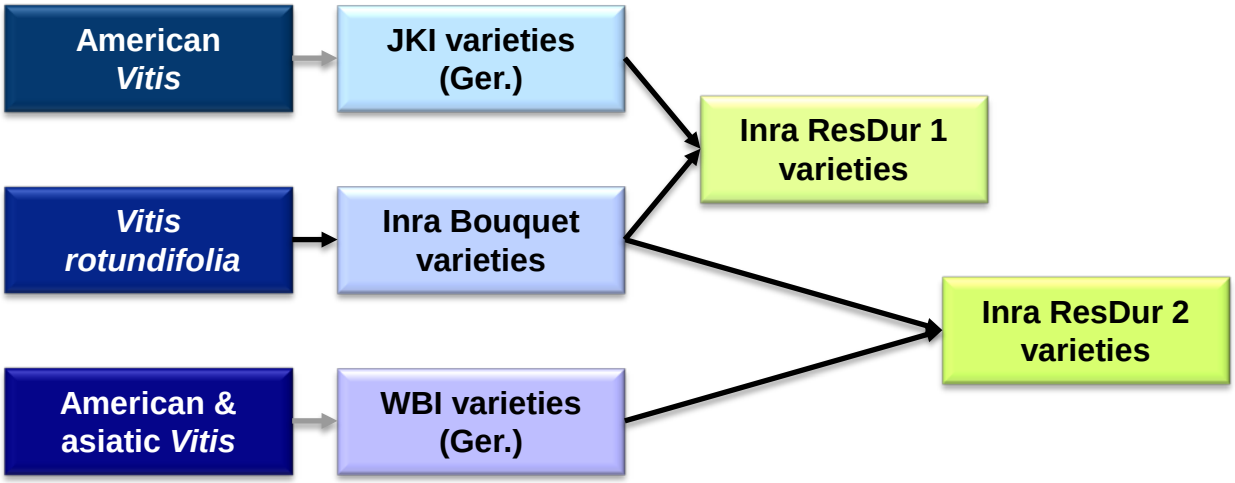
Inra ResDur Programme

Incremental & partnership process



Inra ResDur Programme

Incremental & partnership process



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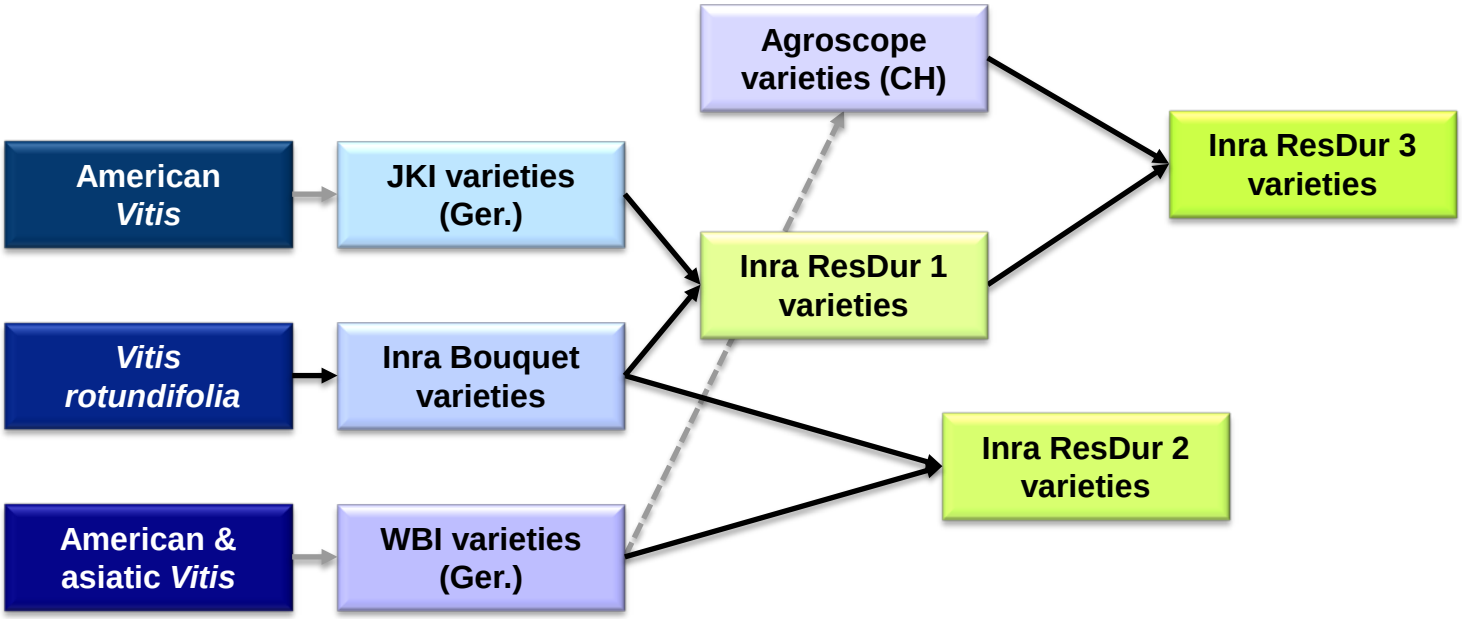
Incremental & partnership process



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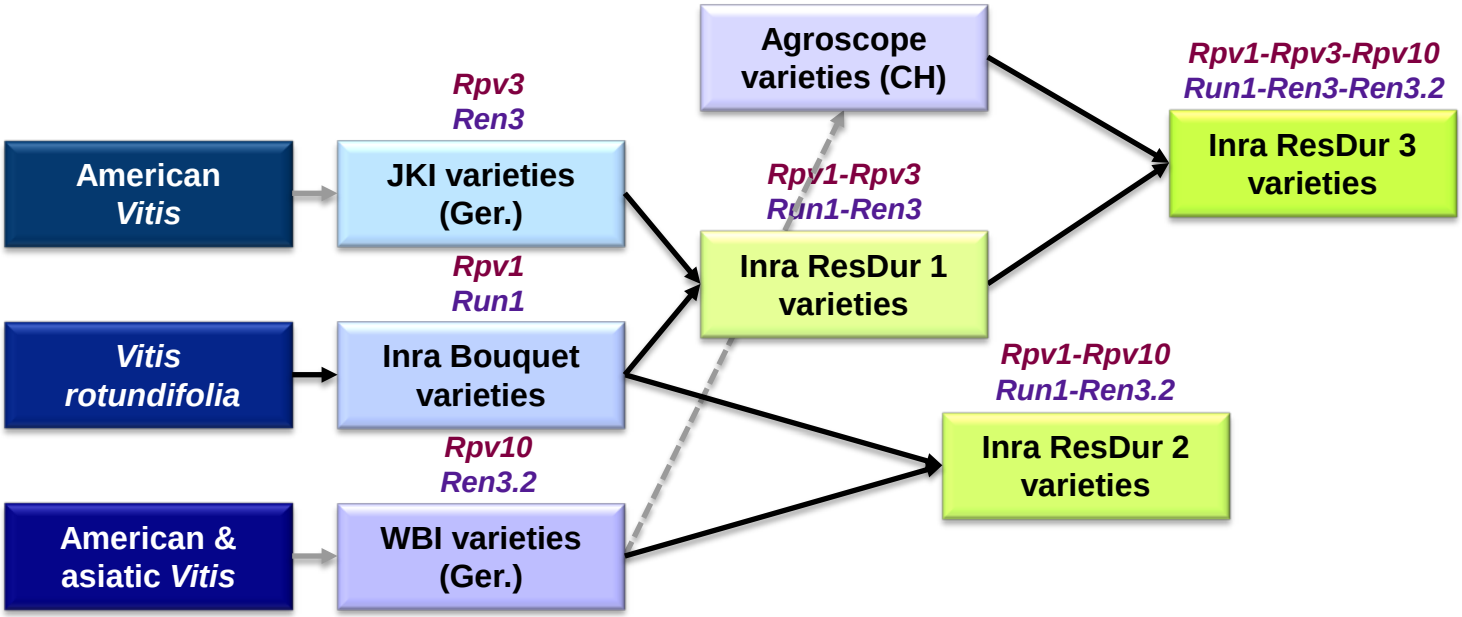

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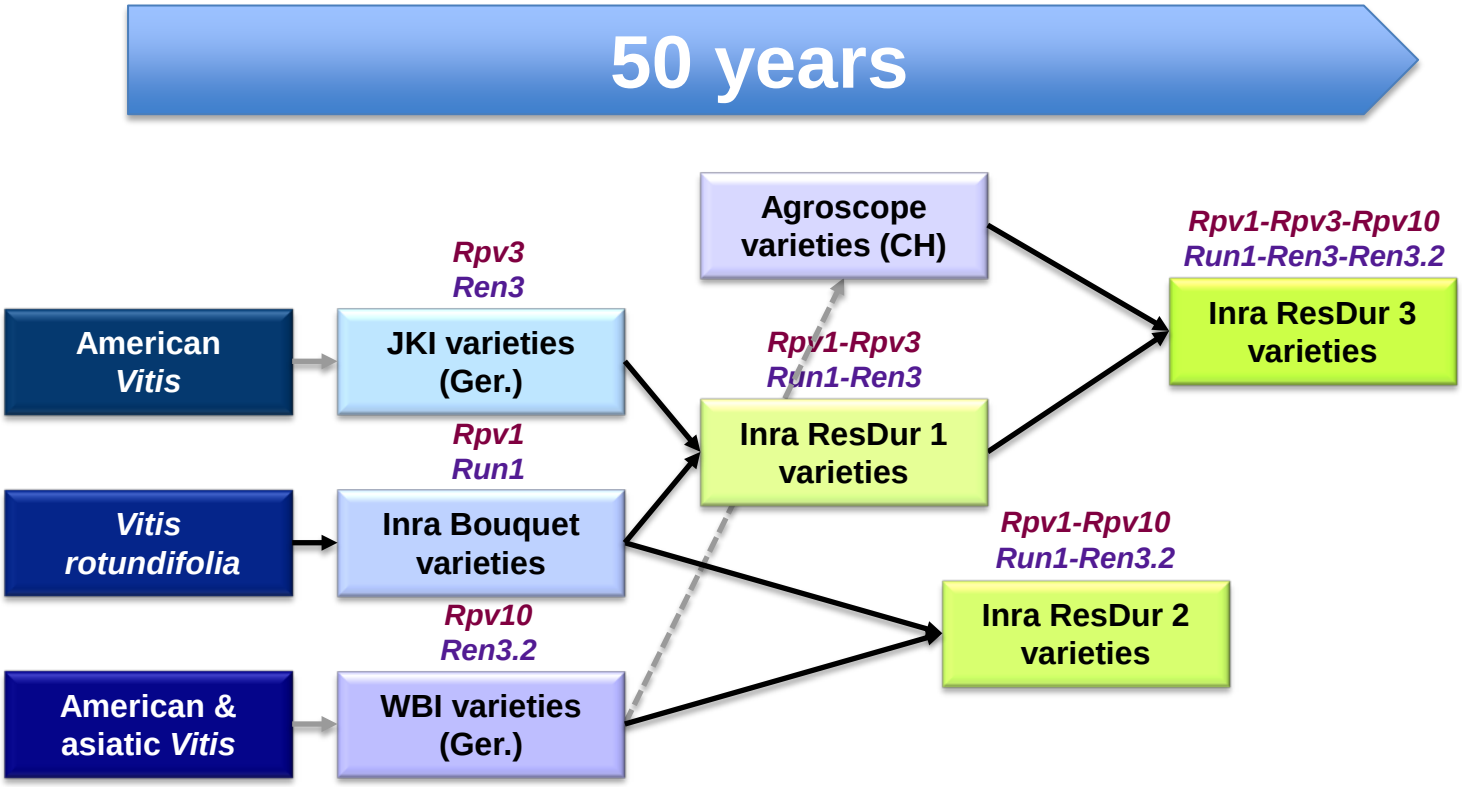
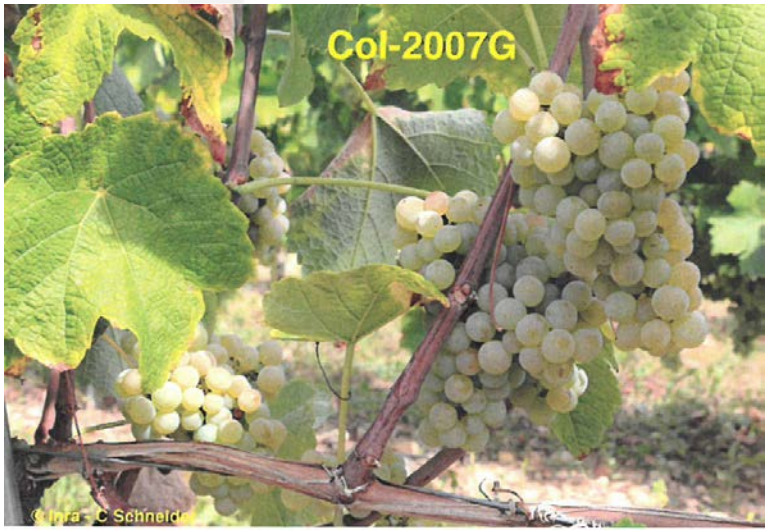
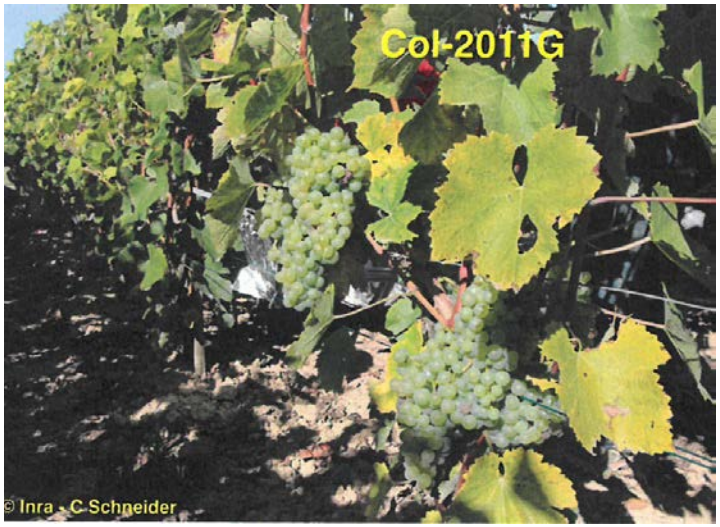


ResDur 1 varieties



Floreal

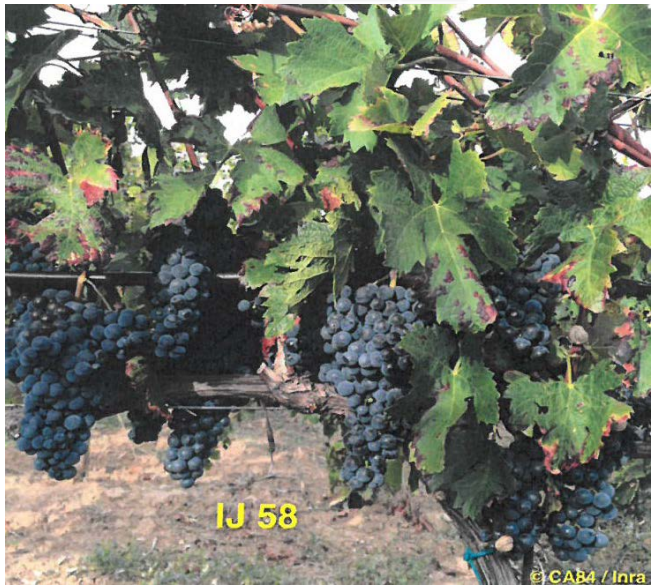


Voltis

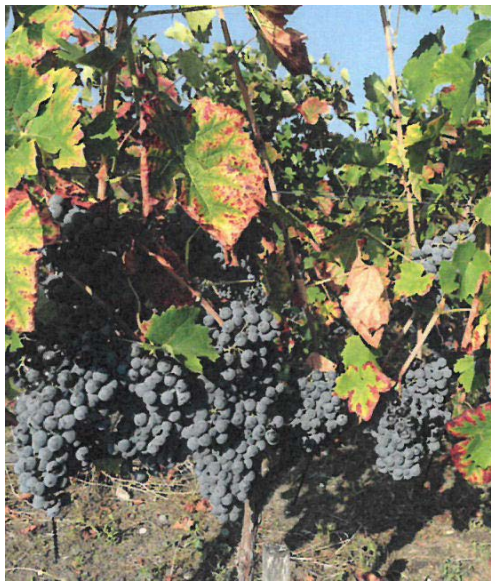
Villaris x Mtp 3159-2-12

- **Very high level of resistance to downy mildew**
- **Full resistance to powdery mildew**
- **Mid productivity**
- **Ripeness 2d satge**
- **Expressive and juicy wines / full-bodied and flexible**

ResDur 1 varieties



Vidoc



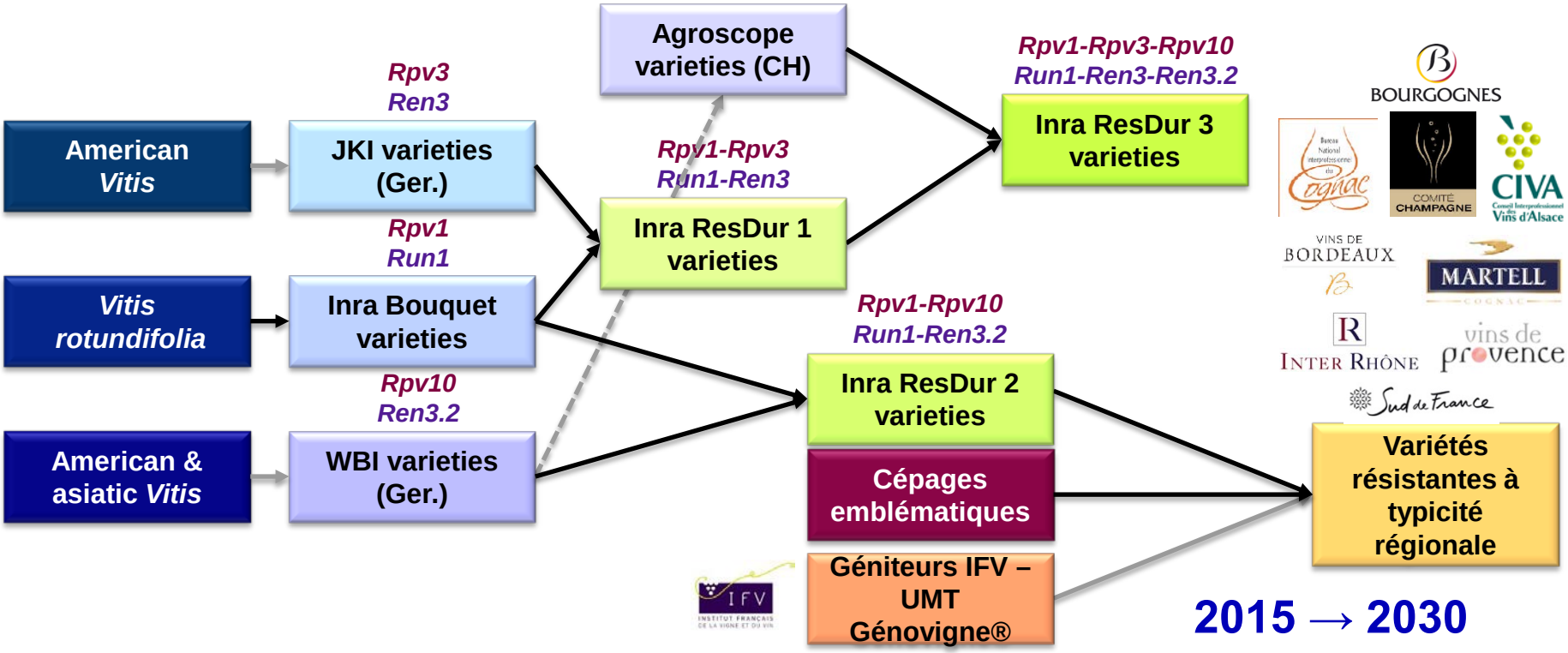
Artaban

Mtp 3082-1-42 x Regent

- **High level of resistance to downy mildew**
- **Full resistance to powdery mildew**
- **Good productivity**
- **Ripeness 2d stage / late**
- **Ligth and fruity wine/ powerful, that age well**

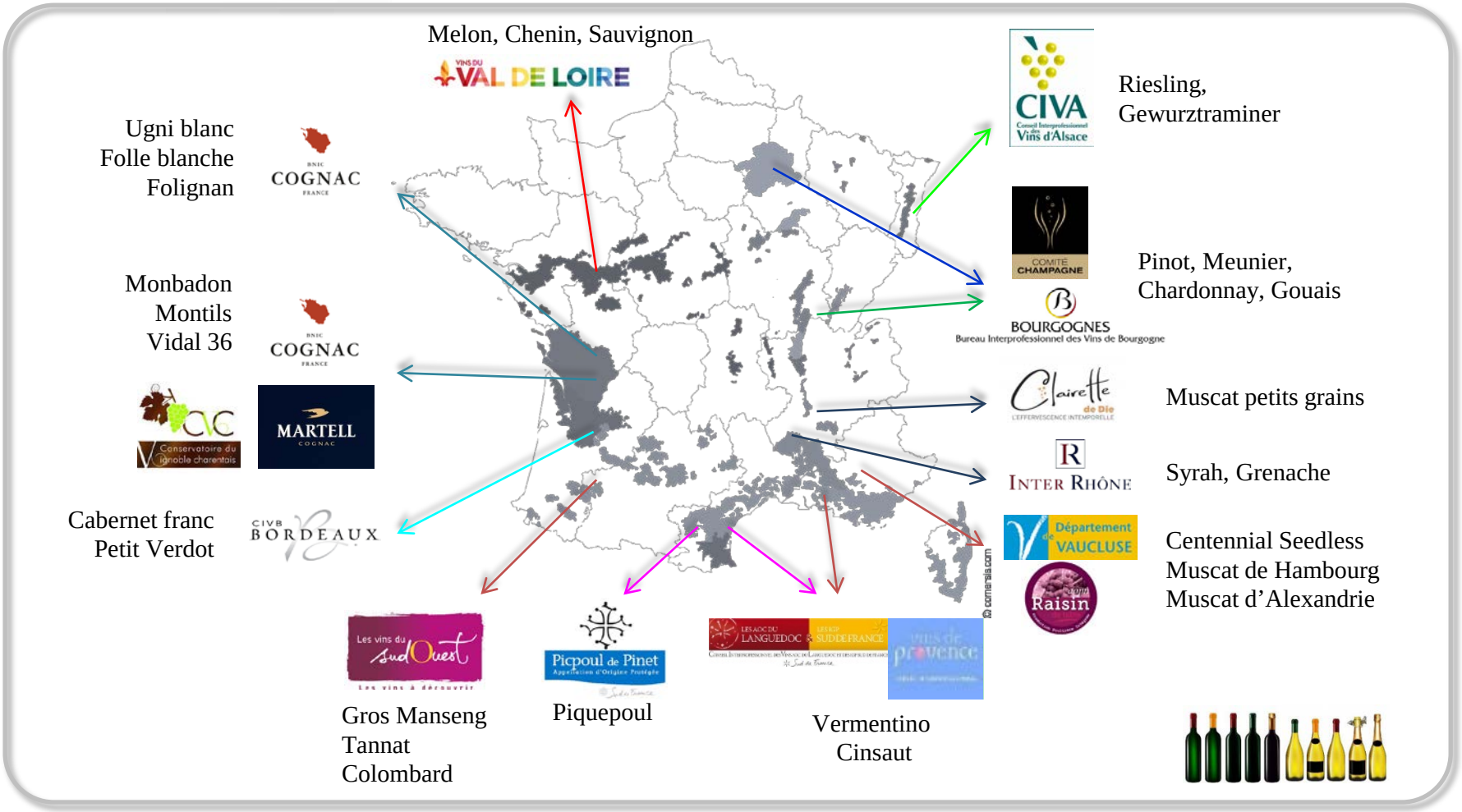
Inra ResDur Programme

Incremental & partnership process



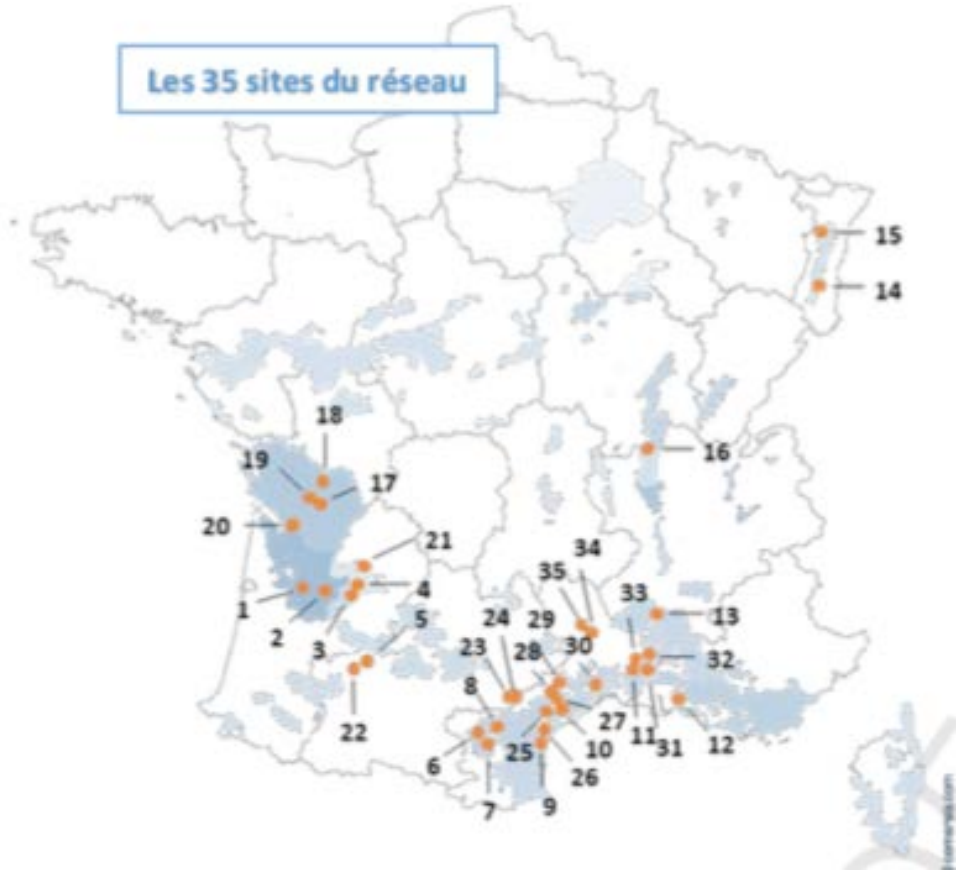
Varieties diversification – regional wines typicality

Current programmes => 1 400 resistant genotypes in 2020 !



Our strategy - combining technical solutions

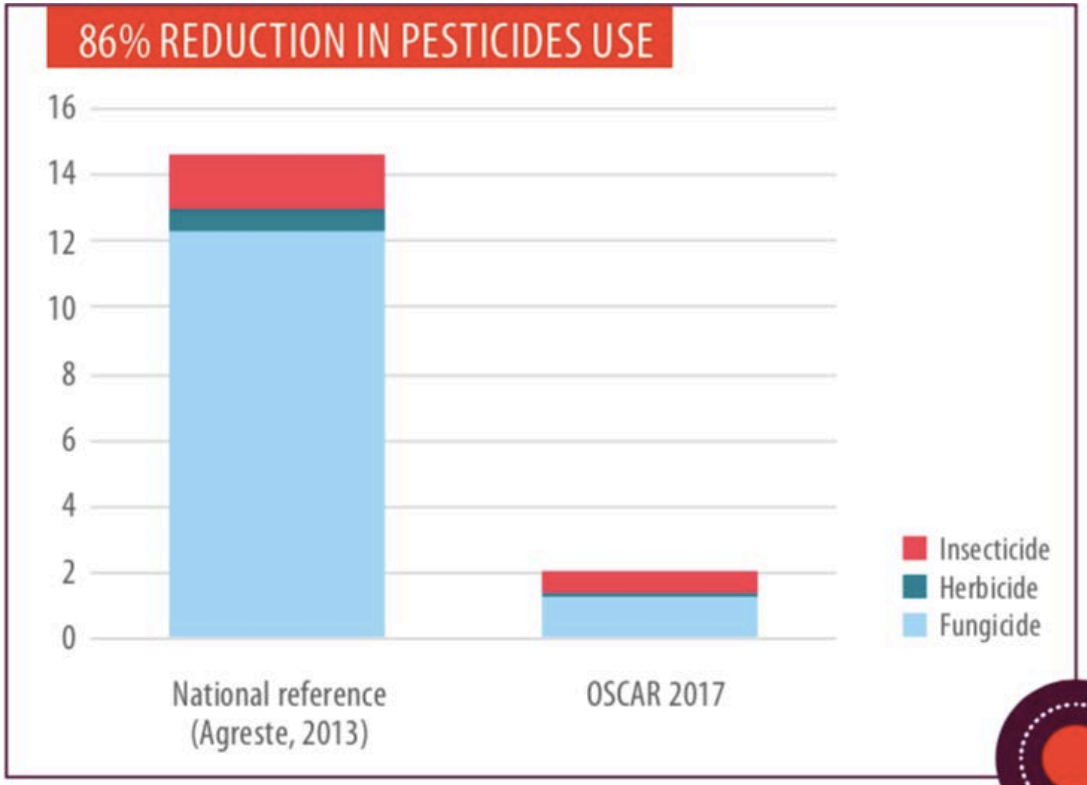
- Monitor the efficiency of resistant varieties AND fungi evolution



Observatoire national du déploiement des cépages résistants

➢ Towards a European OSCAR network ?

First results



Susceptible varieties

Resistant varieties

A long term strategy

An increasing variety offer

2018 **2021** **2024** **2030**

ResDur1

Inra-Bouquet

EU Offer

ResDur2

GénoVigne

ResDur3

Regional typicity R varieties

⇒ **Diversification** of the varieties

⇒ **Diversification of the pyramiding architectures**

⇒ Evaluation of the impact on the wines

⇒ Impacts at the EU scale?

⇒ International deployement

⇒ New breeding objectives

3 new challenges for viticulture

1 - From a technical aspect

As a perennial plant, need to characterize varieties for :

- Sustainability of resistances and agronomical adaptation
- Wine quality : single blend or several blends
- Combine as early as possible genetic selection with wine tasting quality criteria
- Adaptation to climate change

- **To bring reliable information to growers**
- **To monitor the use of resistant varieties – evaluate the risk of resistance genes overcoming**

3 new challenges for viticulture

1 - From a technical aspect
2 - For the market and consumers

Variety, along with its terroir, is the main identifier for the consumer

- Single blend wine (Merlot, Cabernet Sauvignon, Chardonnay, Sauvignon, ...)
- Identity of wine terroir (Chardonnay and Pinot in Burgundy, Sangiovese for Chianti, Tempranillo and Grenache for Rioja, ...), essential European heritage

3 new challenges for viticulture

1 - From a technical aspect
2 - For the market and consumers
3 - For regulatory aspects

- **At European level**
  - Bring official information on resistances : **EU Catalogue**
  - Produce AOP wines with « *Vitis* » varieties
  - Protect the use of the **denominations** of emblematic European varieties / consumer protection

- **At national level**
  - Integrate variety innovations in IGP and AOP conditions (90% of French production)
  - Frame defined by INAO (presentation of the link to origin)

To keep in mind

- Genetic resistances enable to drastically decrease fungicides use in vineyards
- Genetic resistances to downy and powdery mildew are a key element of a system **combining** also biocontrol, epidemy monitoring, cropping systems evolution, digital technologies, …
- Growers have a key role in the process
- Resistant varieties should not induce resistance from consumers

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DE LA VIGNE ET DU VIN

Special thanks to Christophe Schneider, Didier Merdinoglu, Laurent Delière, François Delmotte, Laurent Audeguin, Loïc Le-Cunff, Jean-Pierre Van-Ruyskensvelde