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# Effects of a cultivar mixture on scab control in apple orchard

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F. Didelot<sup>3</sup>, C-E. Parveaud<sup>4</sup>, C. Gomez<sup>4</sup>, L. Parisi<sup>5</sup>

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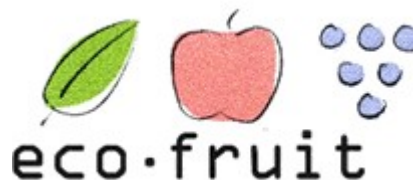
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Institut National de la Recherche Agronomique



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# Why mixing apple cultivars on the same plot ?

- To reduce epidemics of aerial pathogens at the plot scale
- Mixing apple cultivars having different level of scab susceptibility can reduce scab epidemic (*e.g.* Bousset *et al.*, 1997)

- Hypothesis
  - a resource dilution effect
  - a physical barrier



resistant cv. or  
low-susceptible

# What kind of cultivar mixture ?

- Rvi6 gene overcome in some EU countries
  - If the resistance is overcome, mixing resistant and high susceptible cultivars could increase pathogen diversity (Trapman, 2006)
- Mixture of resistant + low susceptible cv

# Aim of the study

Assess the efficiency of a **cultivar mixture**  
**within the row** between  
a **low-susceptible** and a **resistant** cultivar  
on scab development  
in **two** sites

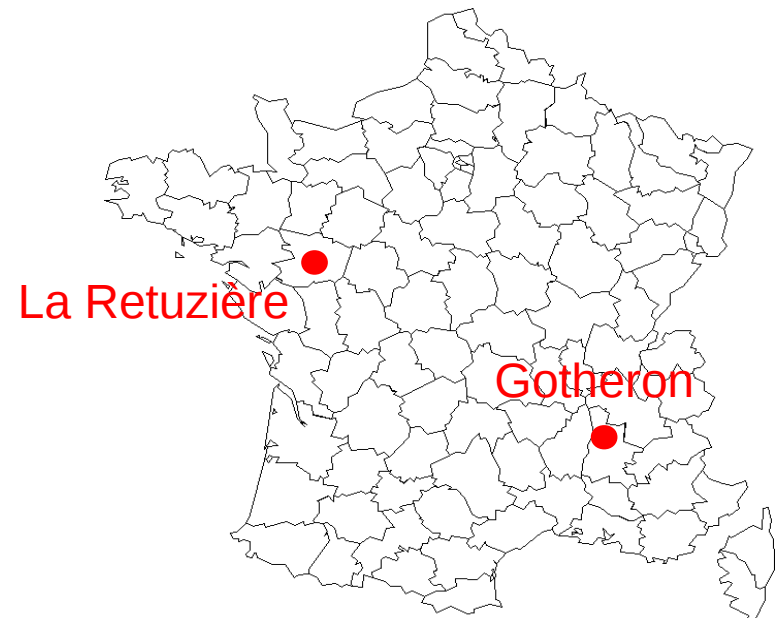
efficiency      scab development

assess

low-susceptible  
cultivar mixture  
resistant cultivar

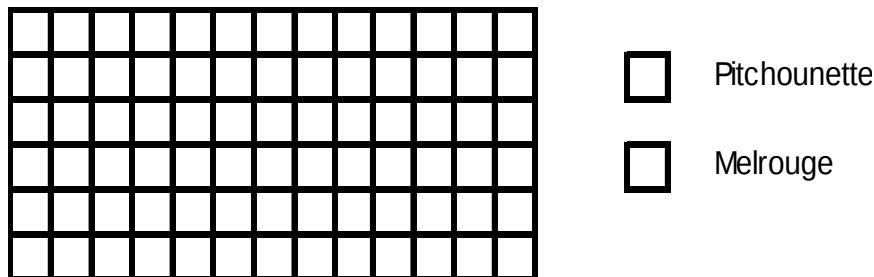
# Experimental orchard

- 2 experimental orchards
  - organic, SE France, Rhone Valley
  - IPM, W France, Loire Valley
- Planted in 2004



# Experimental orchard

- 2 cultivars
  - Melrouge: low susceptibility to scab
  - Pitchounette: resistant to scab (*Rvi6*)
- Melrouge was planted in pure stands and in a within row mixture with Pitchounette



- Treatments were replicated 3 times according to a block design

# Scab control and assessment

- No scab symptom or heterogeneous scab pressure until 2007
- No fungicide application against scab in 2008 and 2009
  - to permit the disease development
  - to make comparison easier
- Rvi6 gene was overcome in June 2008 at La Rétuzière
- Scab assessment
  - scoring on leaves in May and June
    - 80 shoots x 3 repetition x 2 treatments x 2 sites*
  - Scoring on fruits at picking
    - 20 fruits / tree on each tree*



# Scab infection risks

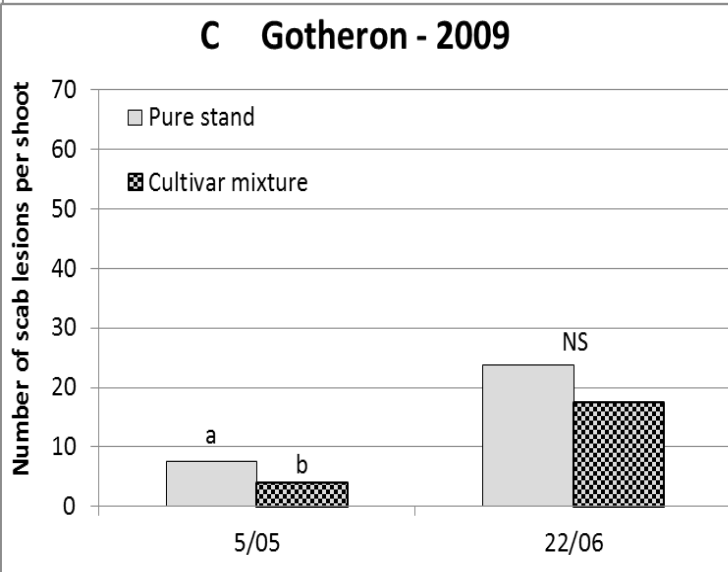
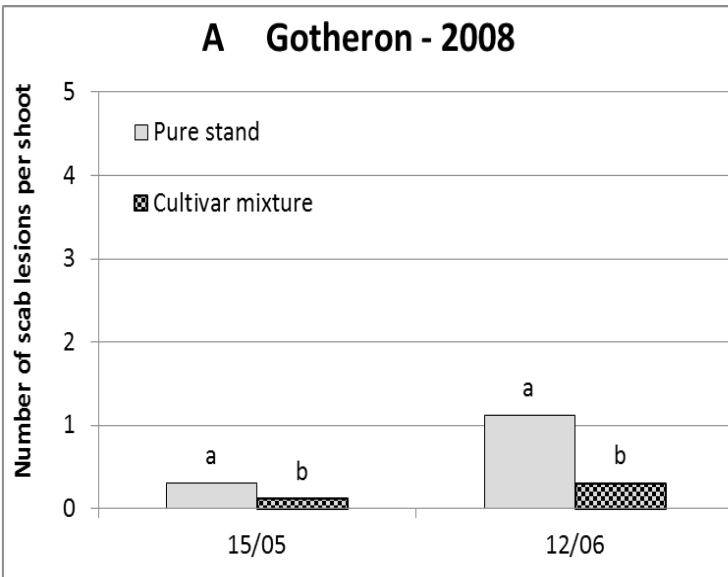


## Scab infection risks

		Primary inoculum	Angers	Light	Moderate	Severe	<b>Total</b>
<b>Gotheron</b>	2008	Low	1	11	2	6	<b>20</b>
	2009	High	0	4	3	0	<b>7</b>
<b>La Rétuzière</b>	2008	Low	4	7	7	5	<b>23</b>
	2009	High	1	5	5	7	<b>18</b>

Gotheron 2008 : beginning of scab development in the orchard

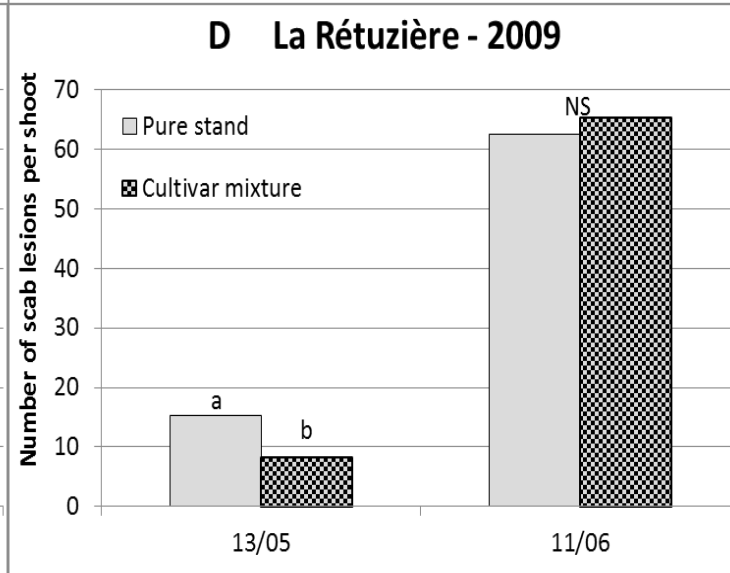
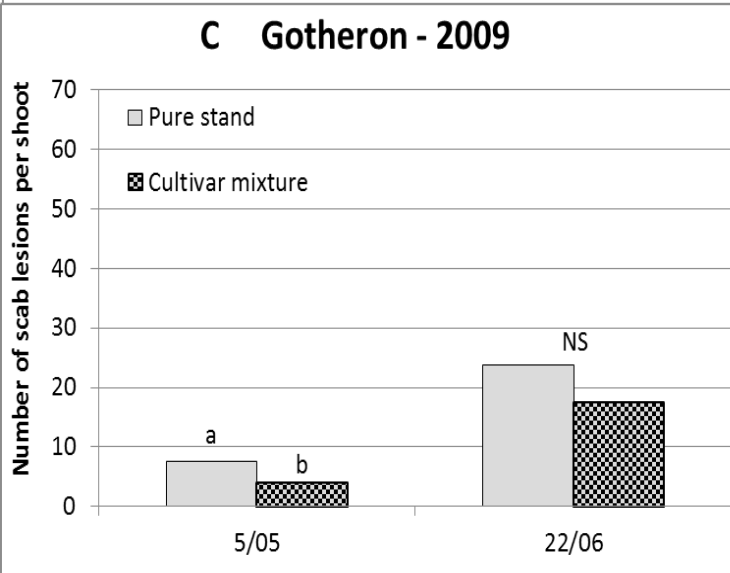
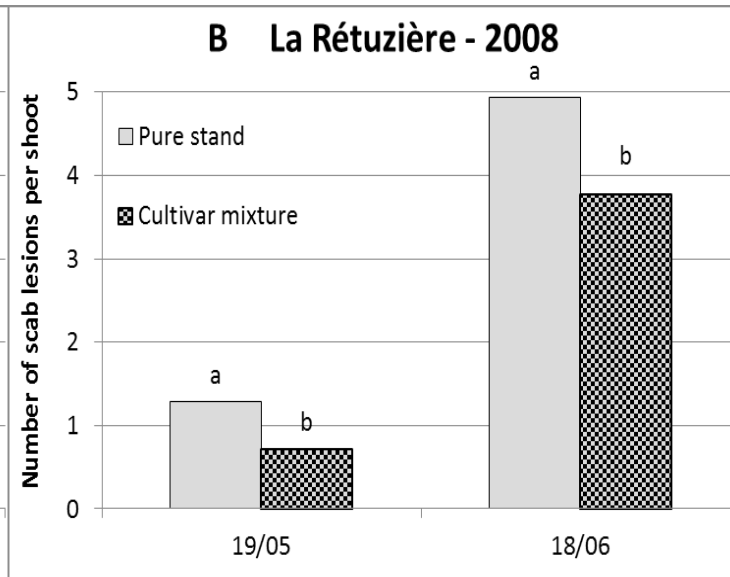
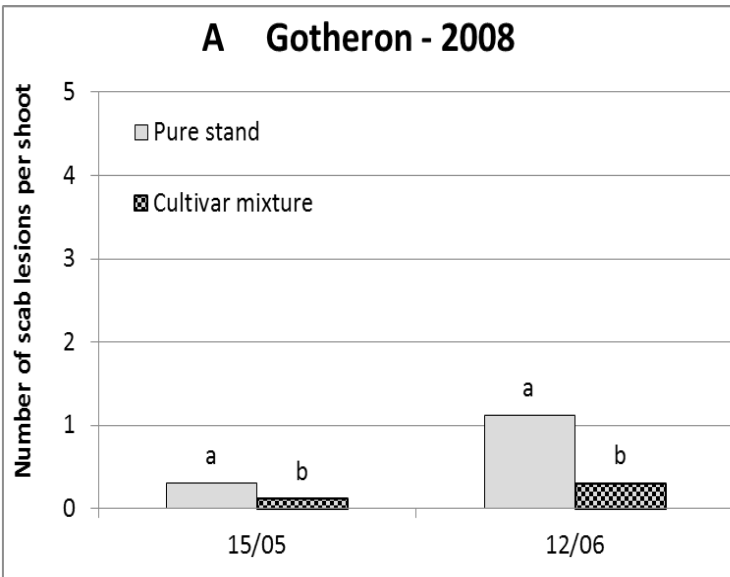
# Scab shoot severity



- Low level of disease at Gotheron in 2008

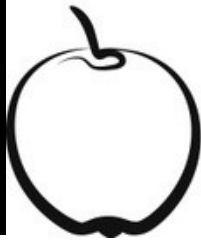
- Effect of the cultivar mixture on number of scab lesions except in June 2009

# Scab shoot severity



- Low level of disease at Gotheron in 2008
- Effect of the cultivar mixture on number of scab lesions except in June 2009

# Incidence of scab at picking



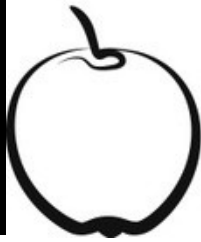
	Percentage of scabbed fruits at picking	
	Gotheron - 2008	
	Melrouge	Pitchounette
Pure stand	14.9	-
Cultivar mixture	9.3	0.0
<i>P-value</i>	<i>0.0666</i>	

	Percentage of scabbed fruit	
	Gotheron - 2009	
	Melrouge	Pitchounette
Pure stand	82.2	-
Cultivar mixture	76.2	0.0
<i>P-value</i>	<i>0.0458</i>	

- Significant effect of cultivar mixture on fruit damages on Melrouge in 2008 and at Gotheron in 2009
- No significant effect of mixture at La Rétuzière in 2009 when the level of the disease is high and when Pitchounette is overcome

# Incidence of scab at picking



	Percentage of scabbed fruits at picking			
	Gotheron - 2008		La Rétuzière - 2008	
	Melrouge	Pitchounette	Melrouge	Pitchounette
Pure stand	14.9	-	73.0	-
Cultivar mixture	9.3	0.0	60.5	0.1
<i>P-value</i>	0.0666		0.0663	

	Percentage of scabbed fruits at picking			
	Gotheron - 2009		La Rétuzière - 2009	
	Melrouge	Pitchounette	Melrouge	Pitchounette
Pure stand	82.2	-	98.3	-
Cultivar mixture	76.2	0.0	96.0	9.2
<i>P-value</i>	0.0458		0.4769	

- Significant effect of cultivar mixture on fruit damages on Melrouge in 2008 and at Gotheron in 2009
- No significant effect of mixture at La Rétuzière in 2009 when the level of the disease is high and when Pitchounette is overcome

# Conclusions

- The overcoming of the resistance depends on:
  - quantity of inoculum
  - climatic conditions
  - cultural practices (spraying program, sanitation, cv mixture)
  - susceptibility of the cultivar
  - ➔ difficult to assess the relative importance of the cv mixture on the overcoming of the resistance
- Significant effect of the cv mixture observed:
  - between a low susceptible and a resistant cultivar
  - when the resistance is not overcome and the scab pressure is not too high
  - ➔ Extrapolation to commercial orchards tricky
  - ➔ cv mixture must be associated with other cultural practices

Thank you for your attention !

efficiency

scab development

assess

low-susceptible

cultivar mixture

resistant cultivar

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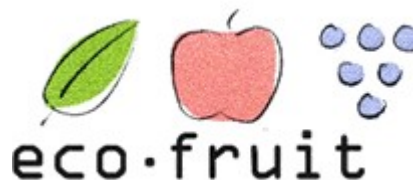
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# Melrouge and Pitchounette mixture within the row





Melrouge fruit, 25 August 2011

