Effects of a cultivar mixture on scab control in apple orchards

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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

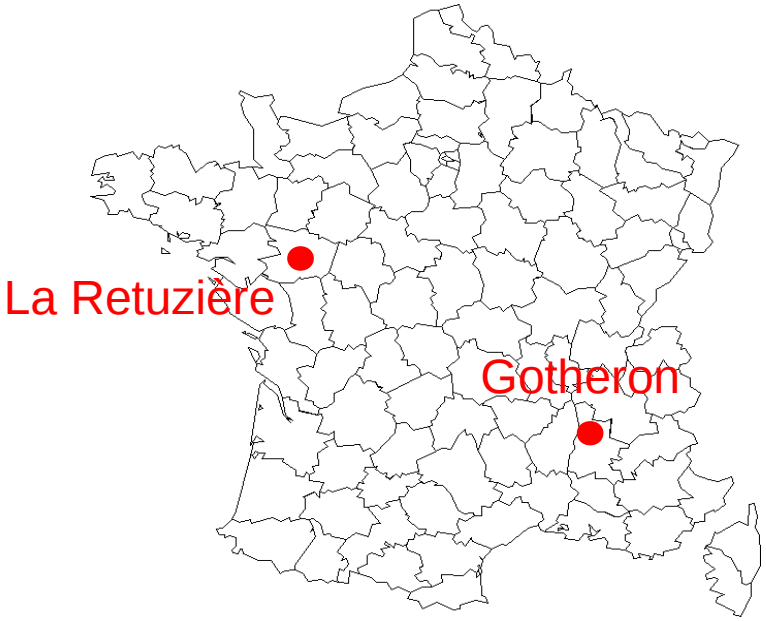
Aim of the study

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

Experimental orchard

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

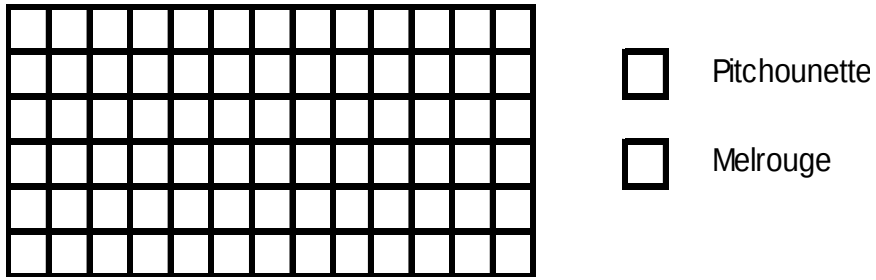
- Planted in 2004



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 overcomed 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

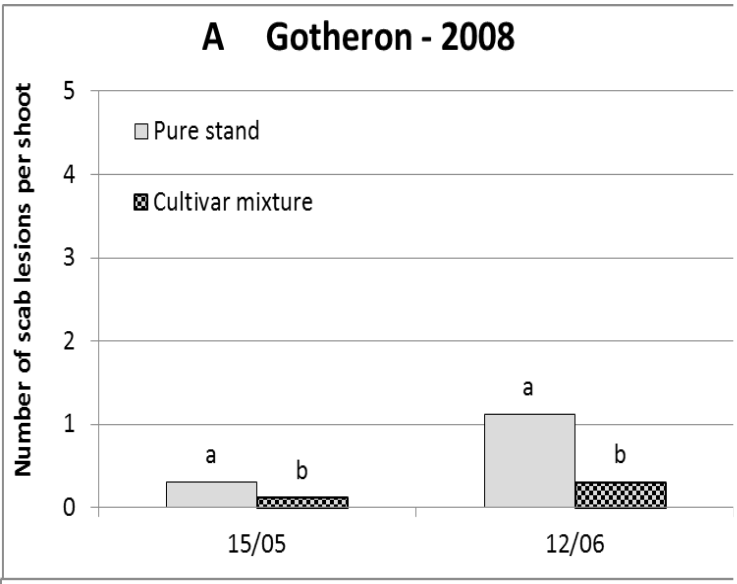
    20 fruits / tree on each tree

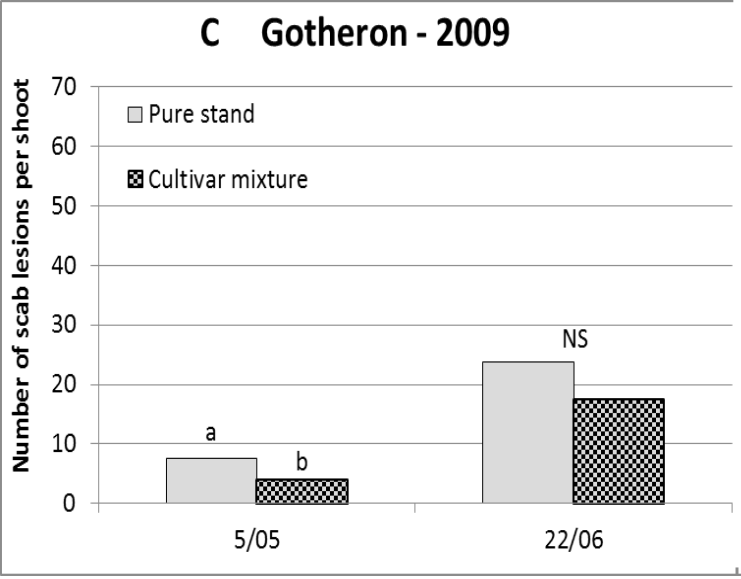
Scab infection risks

			Scab infection risks				
		Primary inoculum	Angers	Light	Moderate	Severe	**Total**
Gotheron	2008	Low	1	11	2	6	**20**
	2009	High	0	4	3	0	**7**
La Rétuzière	2008	Low	4	7	7	5	**23**
	2009	High	1	5	5	7	18

Gotheron 2008 : beginning of scab development in the orchard

Scab shoot severity

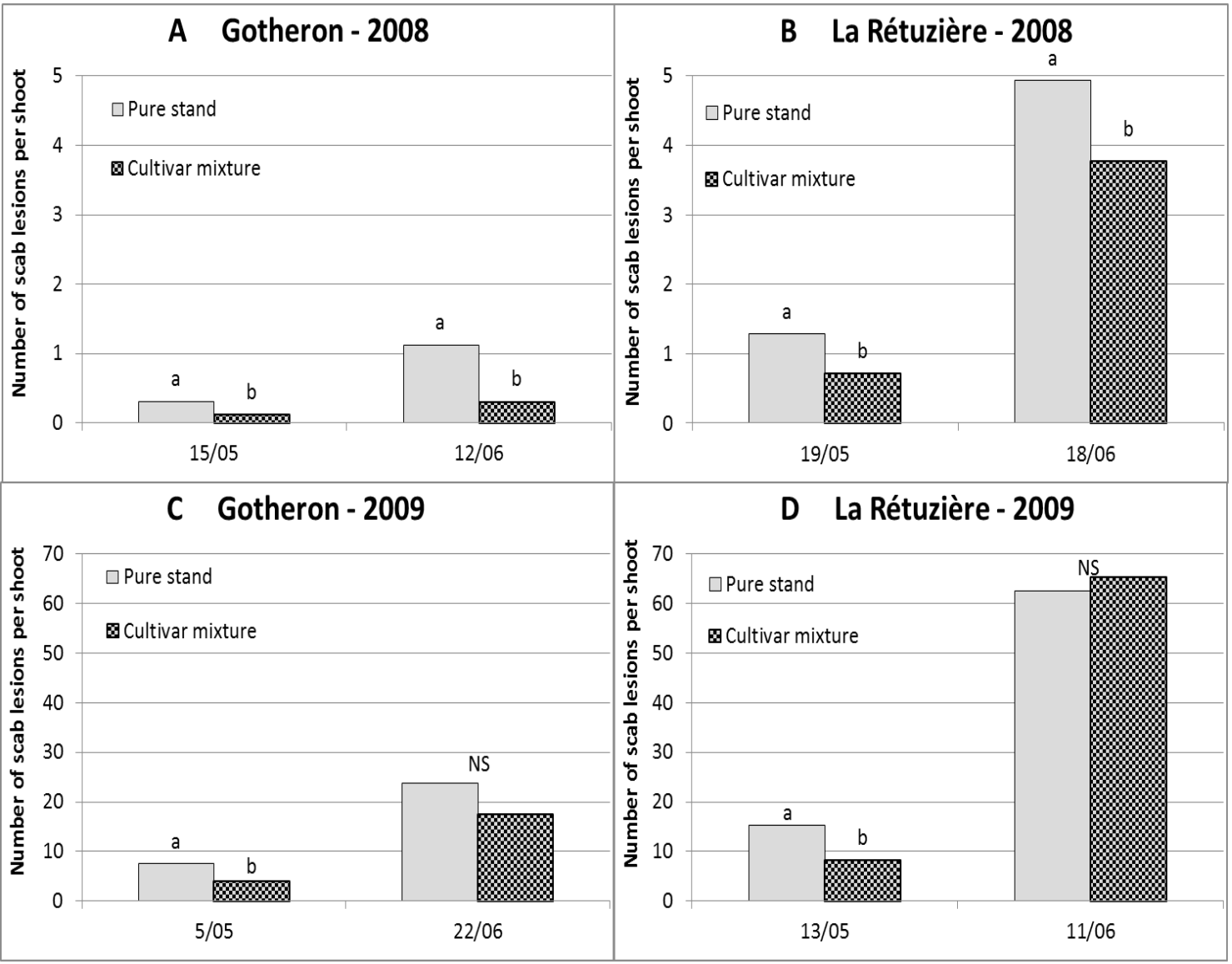




- Low level of disease at Gotheron in 2008

- 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
P-value	*0.0666*	
	Percentage of scabbed frui	
	Gotheron - 2009	
	Melrouge	Pitchounette
Pure stand	82.2	-
Cultivar mixture	76.2	0.0
P-value	*0.0458*	

- 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
P-value	*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
P-value	*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 to high

  ➔ Extrapolation to commercial orchards tricky

  ➔ cv mixture must be associated with other cultural practices

Thank you for your attention !

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Melrouge and Pitchounette mixture within the row

Melrouge fruit, 25 August 2011