Peach aphid management in organic and conventional orchards: how to reconnect efficiency and ecology ?

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Introduction

- Peach in France : 16 000 ha (316 ha in OF)
- Aphids => serious damage

Direct symptoms :
Leaves' deformation
Reduced tree vigour

Undirect symptoms :
Plum Pox Virus

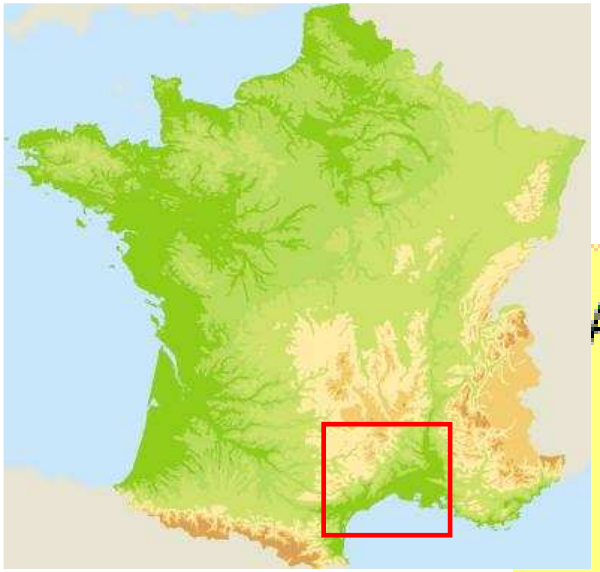
- Protection dominated by chemicals

$\Rightarrow$ Shift towards an agroecosystem approach

The paradox between efficiency and ecology : Is there a best management strategy ?

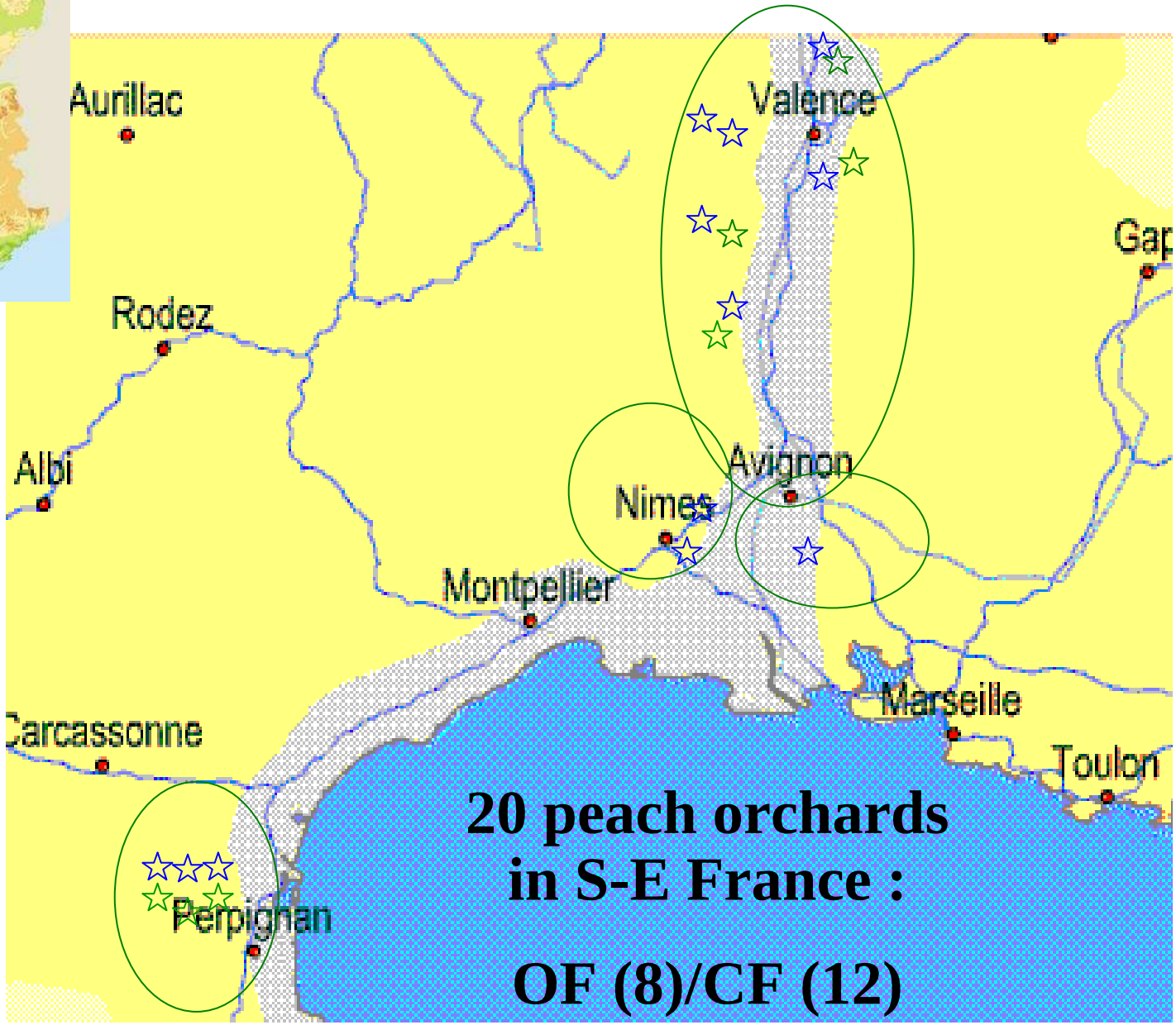
- Identification of farmer's practices
- Characterisation of their strategy
- Assessment of its efficiency (impact on aphids) and ecological respect (impact on beneficials)
- Effect of the tree vigour (Price, 1991) ?

Material & Methods

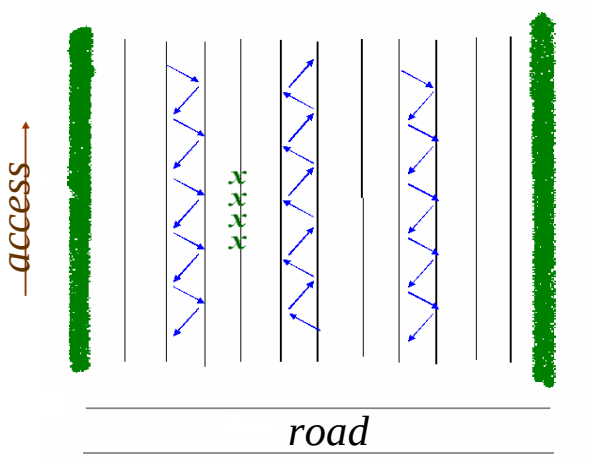


☆ Organic farms

☆ Conventional farms



Aphids' infestations (1)



Aphid's community:

- *Myzus persicae* (Sulzer)
- *Brachycaudus persicae* (Passerini)
- *Brachycaudus schwartzi* (Börner)
- *Hyalopterus amygdalii* (Blanchard)
- *Myzus varians* Davidson

Leclant's classification (1970):

degree of aphid infestation (d)	Number of aphids per shoot (N)
0	0
1	$0<N<5^1$
2	$5^1<N<5^2$
3	$5^2<N<5^3$
4	$5^3<N<5^4$
5	$5^4<N<5^5$

Infestation Index (Chen, 1997) :

$$IF = \Sigma\ 50\ (f_d \times d) \,/\, (5 \times \Sigma\ 50 \times f_d)$$

f_d : frequency of d

Impact on Aphids' antagonists (2)

Antagonist's community :

Coccinellidae; Syrphydae; Hemerobiidae and Chrysopidae; Araneae; Earwigs; Aeolothripidae

⇒ H, shannon diversity index

⇒ A, abundance index

⇒ S, species richness

⇒ E, evenness index

$$H = - \sum [pi \times \log_2(pi)]$$

P_i: the fraction of the species

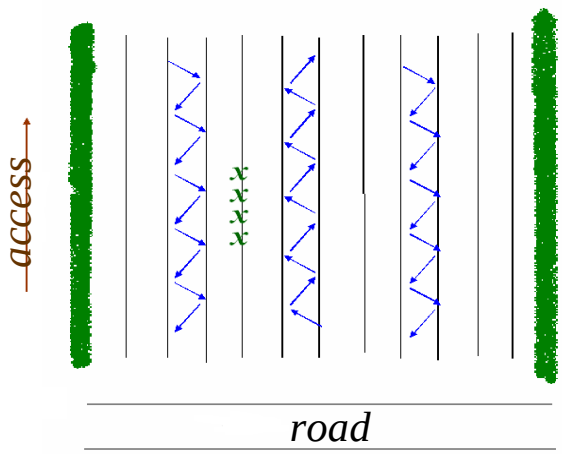
$$E = H/\log_2(S)$$

S : species richness

Effect of the vigour (3)

The morphological parameters monitored are:

- number of leaves (Nf),
- shoot length (Lp),
- fruit diameter (Dfr),
- trunk perimeter (DT),
- number of water-sprouts on the trunk and on fruiting branches (Gmd)
- nitrogen-contents in leaves (N).

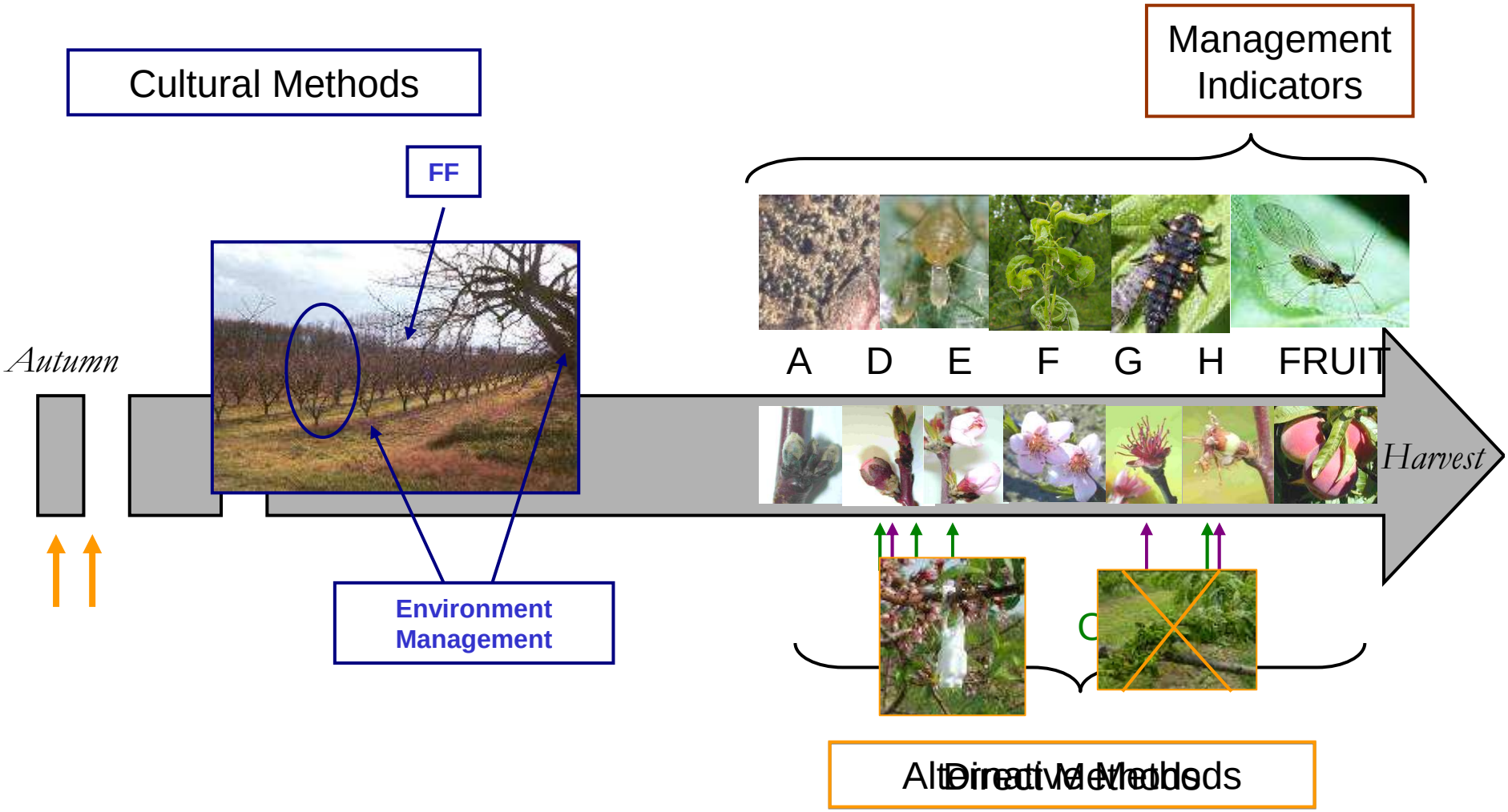


Vigour index (IV):

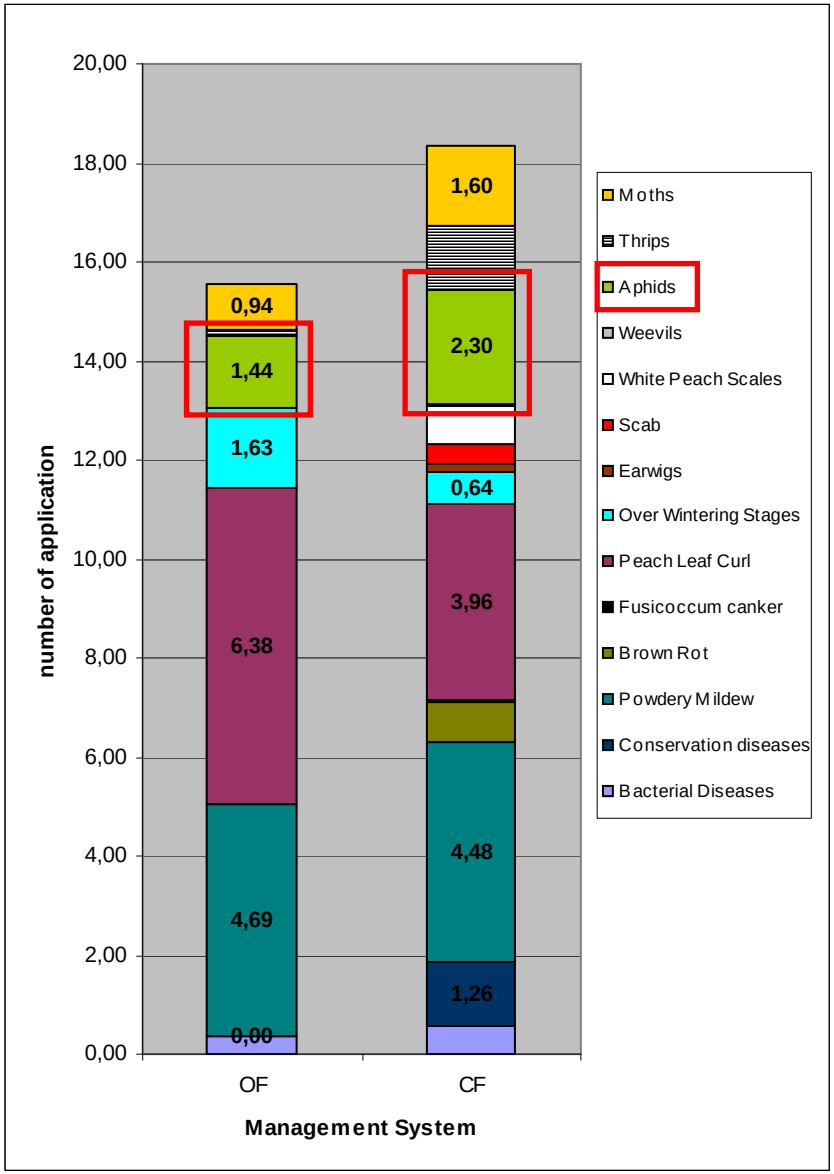
$$IV = \text{Log}\,(Dfr\_AUC \times Lp\_AUC \times Nf\_AUC \times Gmd \times N \times DT)$$

Results

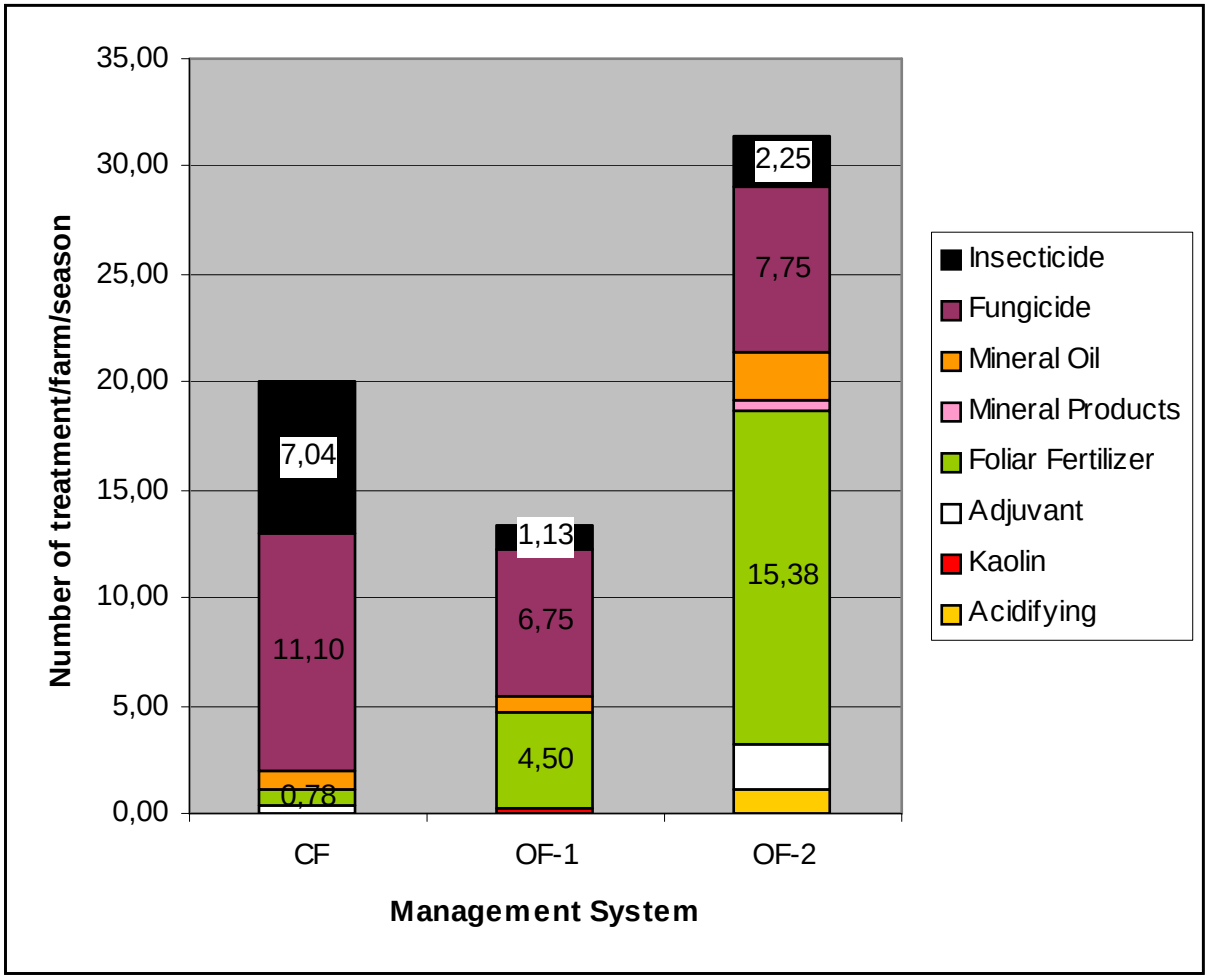
Farmer’s practices (1)



Spray programs (2)



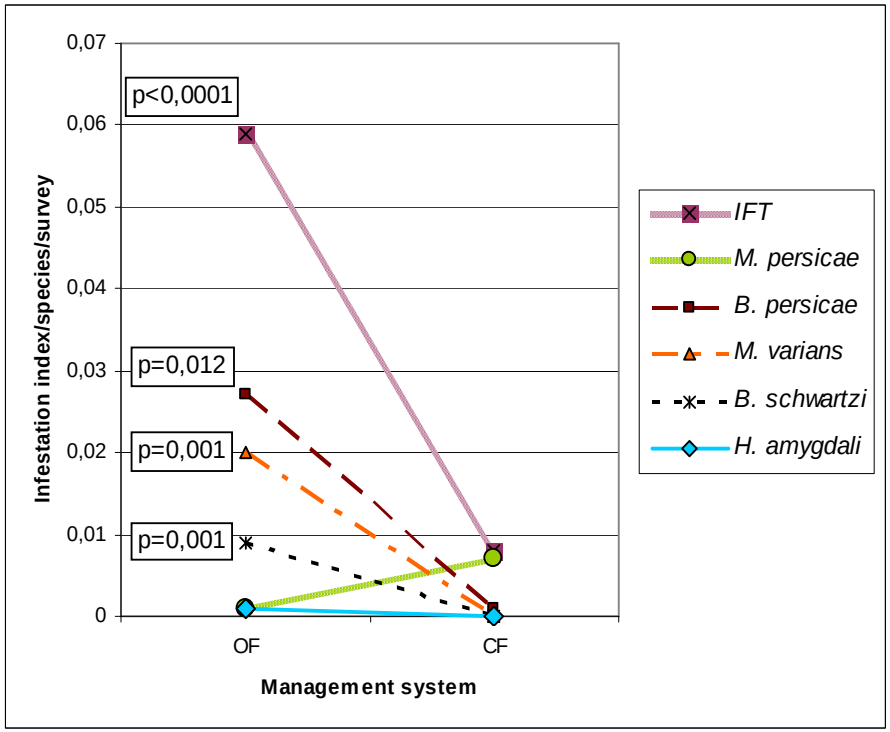
Spray programs (2)

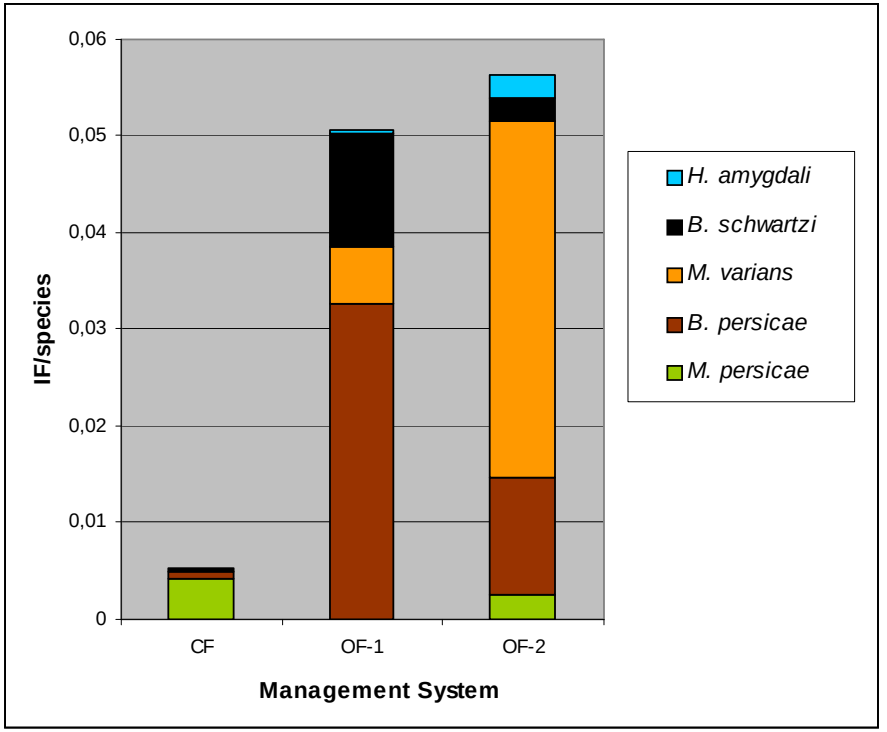


Two strategies can be distinguished in OF

Impact on Aphids (3)

Aphids are more abundant and more diversified in OF

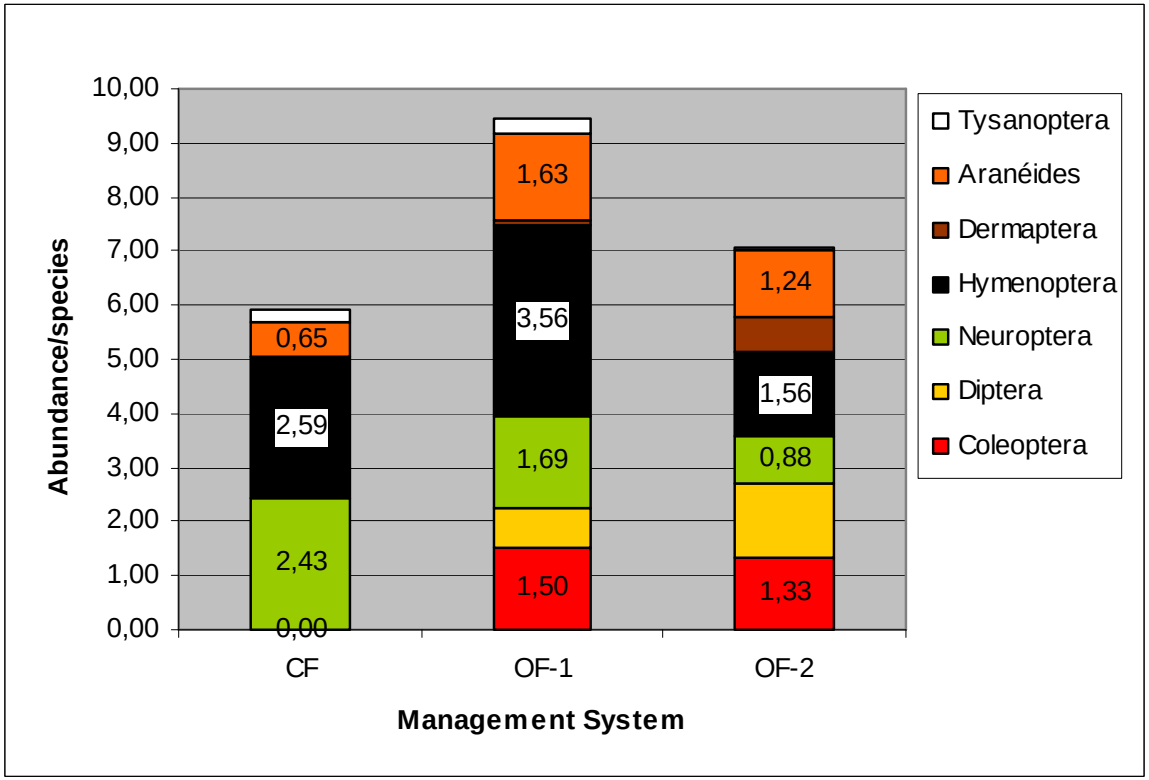




Despite two distinct strategies, equivalent level of infestation

Impact on beneficials (3)

Aphid's antagonists are more abundant and more diversified in OF



	B. Persicae	*B. Schwartzi*	*H. amygdali*	*M. Varians*	Total
Coccinellidae		**0,011**		**0,017**	**0,001**
Syrphydae	**0,027**		**0,033**	**0,003**	**0,005**
Araneidae	**0,045**			**0,031**	**0,033**
Aeolothripidae			**0,015**		
A					**0,032**

P-value from of correlation of Spearman between aphids' infestations and antagonists' abundance.

Effect of cultural methods (4)

- IV a good indicator ?

  => Only the N-content in leaves is not correlated to it, but no relation with the quantity of N-spread.

- Trees in OF tend to be less vigorous than in CF (ns)

- Vigour's effect on Aphid's infestation ?
  - No correlation between IV and IFT
  - IFT linked to shoot's length, and number of leaves/shoot, and dose of N (p=0.001)

  => But in all cases, the effect of the management system predominates

Conclusion

- Conventional farmers limit their intervention to direct control
- Organic management strategies are more integrative, using many indicators and combining different methods
- CF is more efficient but OF preserve antagonists, thus respect ecological processes
- This can be explain through farmer’s practices :
  - Therapeutic toxic treatments OR preventive numerous treatments explains low infestation
  - Non toxic, preventive treatments associated with cultural and alternative methods promote beneficials.

Conclusion

- We can distinguish two strategies among organic farmers
- OF-1 vs OF-2 show better results => the closest from a total system approach, but not yet efficient (Brown, 1999)
- Other technics and methods available or on investigation to achieve better efficiency

Thank you for your attention