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

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# 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**
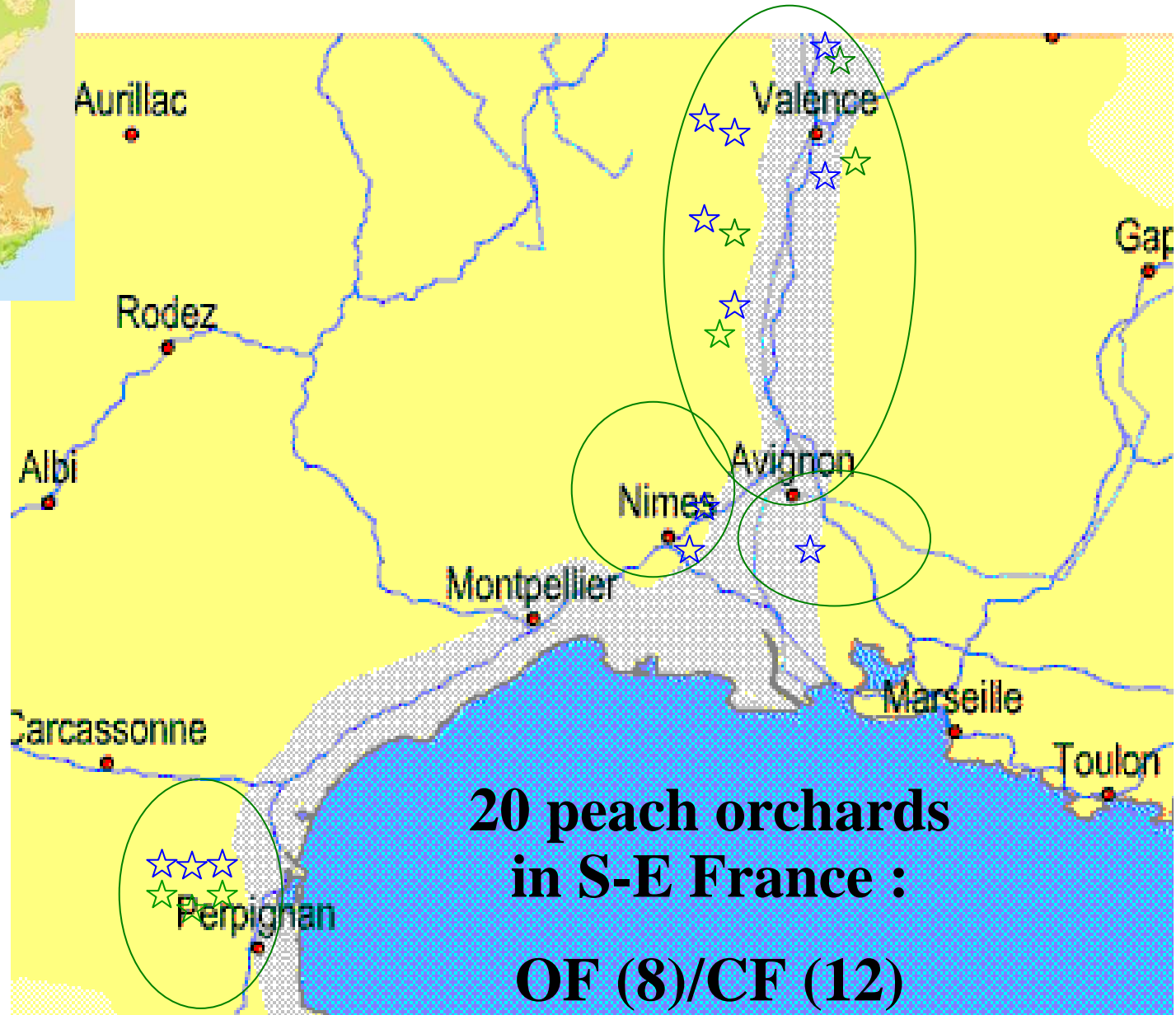
- Protection dominated by chemicals

⇒ Shift towards an agroecosystem approach

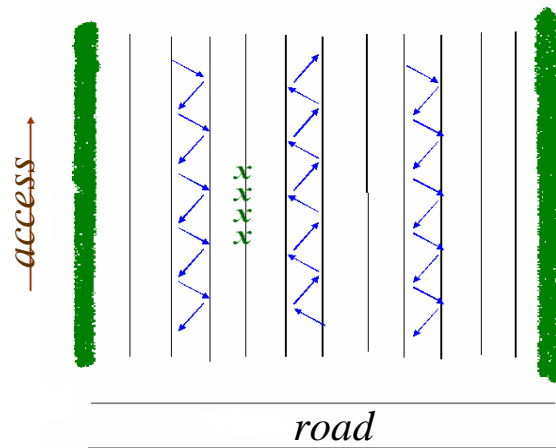## *The paradox between efficiency and ecology : Is there a best management strategy ?*

- 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

**20 peach orchards
in S-E France :**

**OF (8)/CF (12)**

# 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) :*

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

$f_d$ : frequency of d

# Impact on Aphids' antagonists (2)

Antagonist's community :

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

$\Rightarrow$ H, shannon diversity index

$\Rightarrow$ A, abundance index

$\Rightarrow$ S, species richness

$\Rightarrow$ E, evenness index

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

$P_i$: the fraction of the species

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

S : species richness



Earwigs

Eggs of Chrysopidae

Adult and larvea of Syrphydae

Larvae and Adult of Coccinellidae
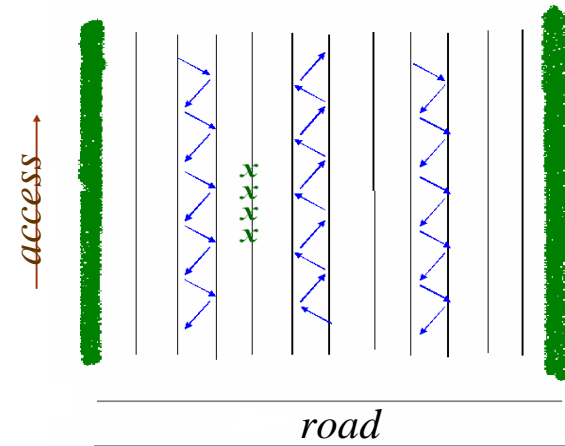
INRA©

# 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)
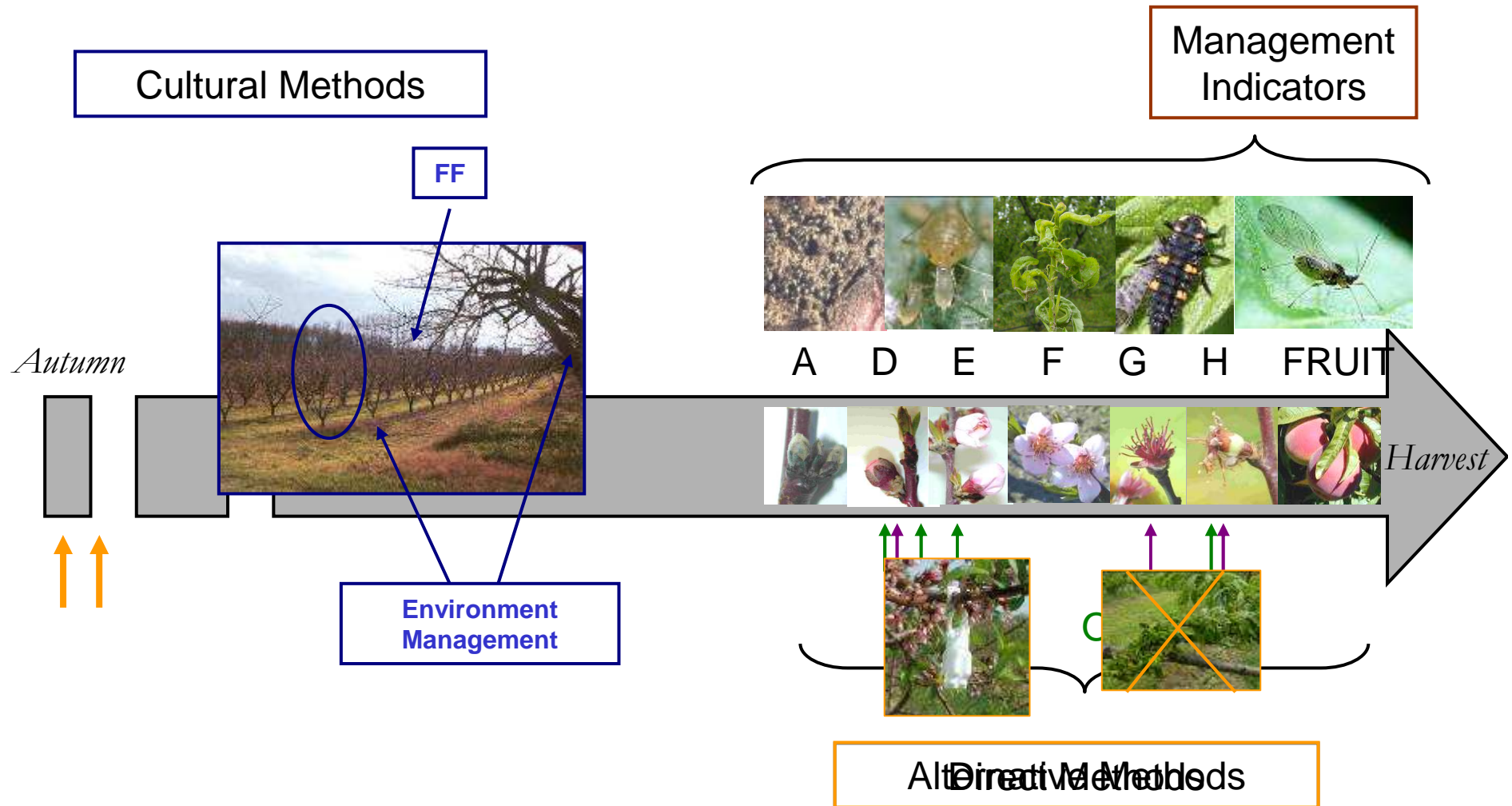
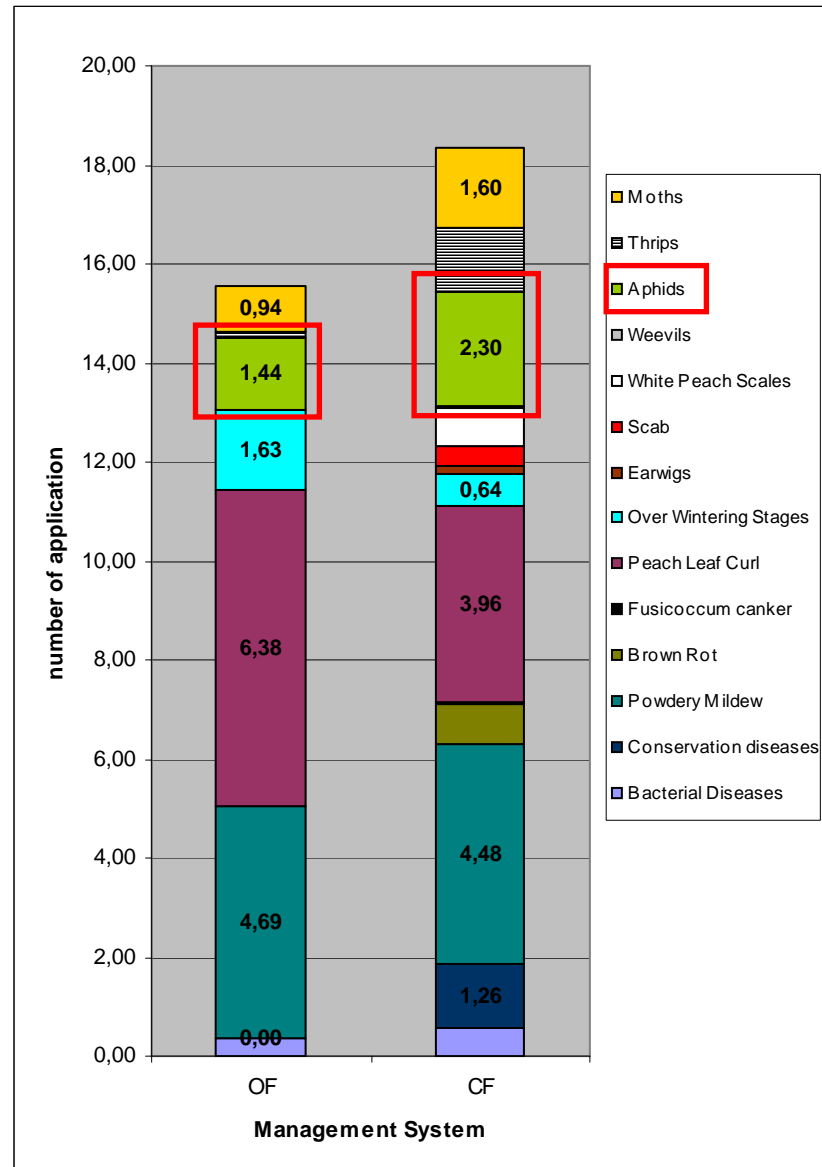- nitrogen-contents in leaves (N).



*road*

*Vigour index (IV):*

$$IV = Log\ (Dfr\_AUC \times Lp\_AUC \times Nf\_AUC \times Gmd \times N \times DT)$$
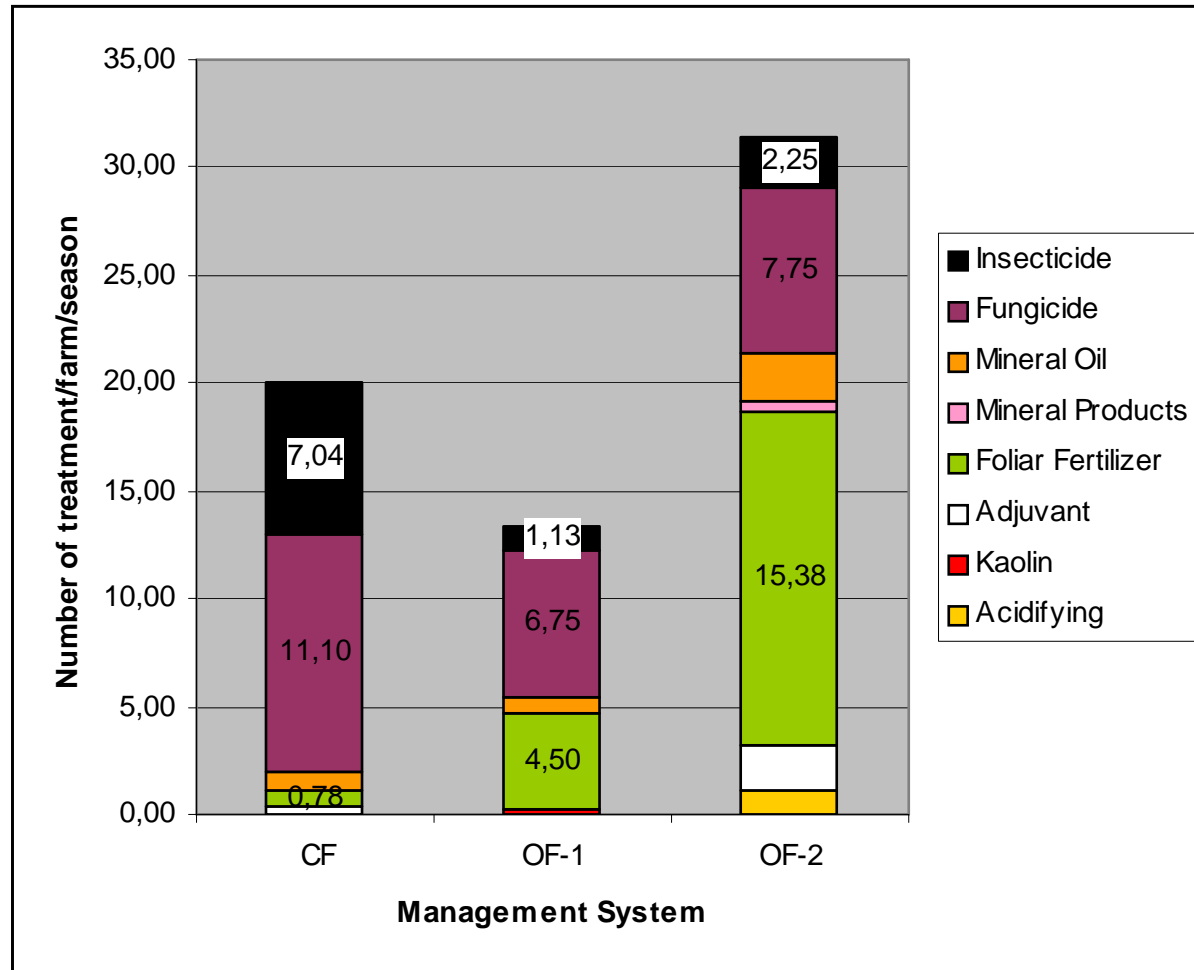
# Results

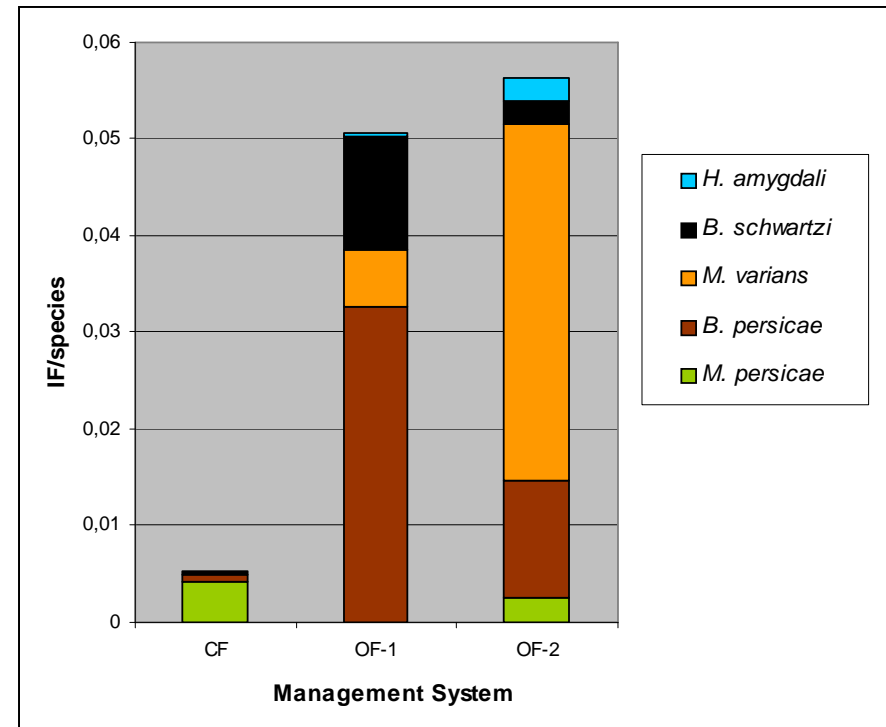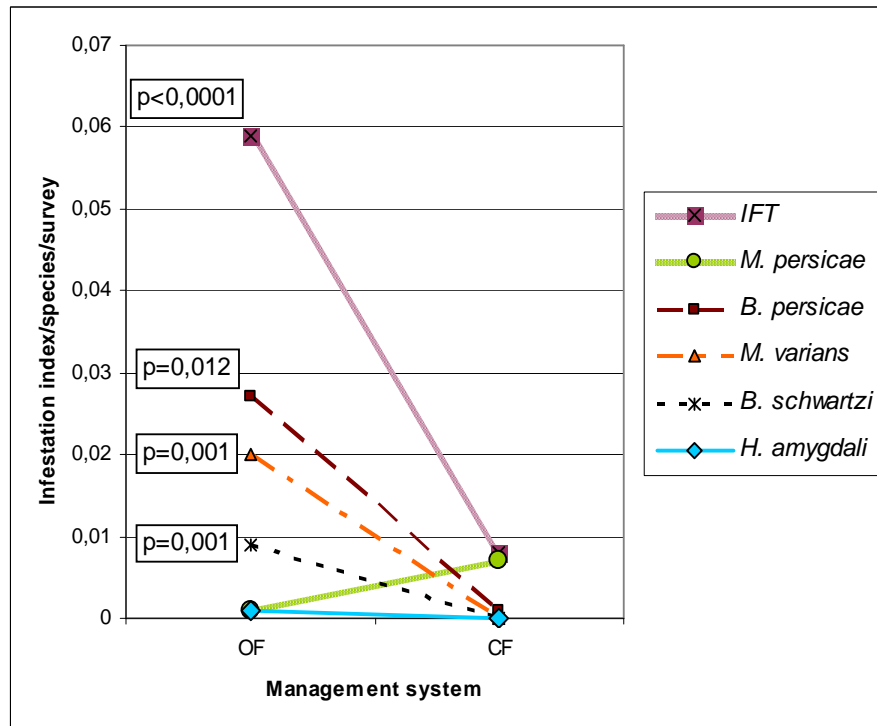# Farmer's practices (1)

# Spray programs (2)

# Spray programs (2)



Two strategies can be distinguished in OF
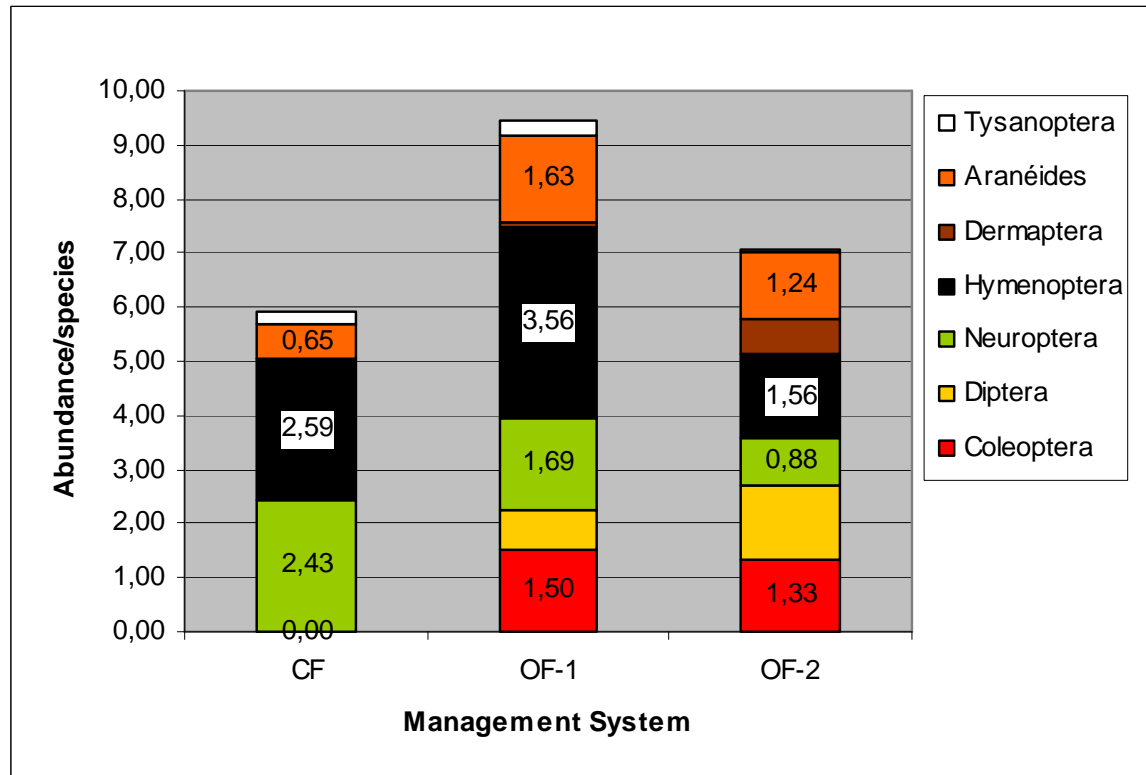
# Impact on Aphids (3)

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