
# The European Fruit Network - EUFRUIT

# State of the art on integrated apple production in research

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(WP3 leader : Reduction in pesticide residues)

# EUFRUIT WP3 Partners

- Aarhus University, DK
- Pcfruit, BE
- Ctifl, FR
- ESTEBURG-OVA, DE
- Wageningen University & Research, NL
- IRTA, ES
- Agroscope, CH
- Laimburg, IT
- USAMV, RO
- LRCAF, LT
- Freshfel, BE
- University of Greenwich, UK
- University of Hohenheim, DE
- University of Bologna, IT
- INRA, FR
- NIAB EMR, UK

Optimise the treatments, but on which basis?

Choose pesticides, but how?

Use alternatives, but which?

How to limit the negative impact on environment?

In case of residues on fruit, is it possible to remove them?

Integrated Pest Management

# How to reduce pesticide residues on fruit and in the environment?

# Apple scab : inoculum reduction

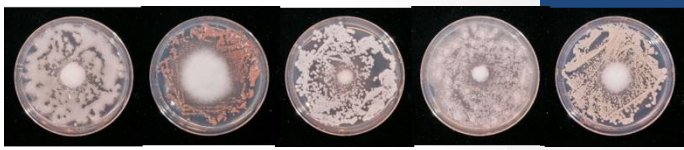
## Strategic watering to release ascospores in dry periods

- 2 x 1.4 mm necessary for spore release
- One watering can release 25 - 40% of spores
- Large amounts of water needed.
- Still spores maturing that cannot be released.
- Most trials show inconclusive or no effect on scab.


## Rain cover to limit projections and contaminations

- Differences between varieties (Braeburn, Gala, Rosy Glow)
- In some cases, leaf wetness is higher under cover
- Development of powdery mildew, wooly aphids
- Less light, less color, stronger shoots growth
- Incidences on yield
- Not adapted to windy situations. Retractable roof ?
- Costs and reduced life time
- Interesting results also against *Neofabraea spp*.

# Biocontrol agent (BCA), against storage diseases



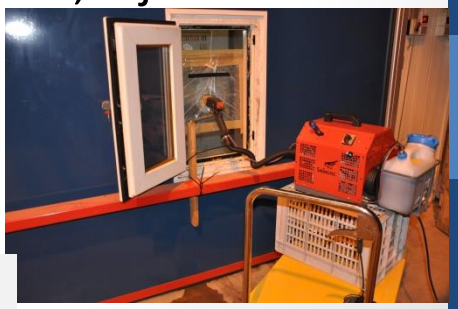
Agroscope

## Microscopic BCAs

- Strong antagonistic (in vitro) activity of *Metschnikowia pulcherrima* against different fungal pathogens
- Mode of antagonism: secreted factors and volatiles
- *M. pulcherrima* can be formulated and be sprayed in field
- *M. pulcherrima* treatments in the field reduced storage rot incidence in combination with fungicides

## Nebulisation of BCAs in cold storage rooms

- Compatibility of BCA with chemical fungicides has to be checked
- Distribution of BCA in cold storage room depends on air flow, injection nozzles, positioning fogger vs ventilation and paloxes
- Variable deposit in paloxes
- Efficacy varies a lot and are not so high (max. 50-60%)



pcfruit

# A physical barrier against codling moths



## Exclusing netting

- Two different systems :

1) roof cover (hail nets) and nets on the sides

2) single row cover system

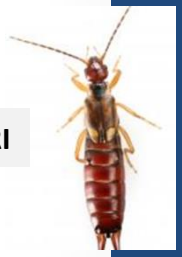
- More than 10 years experiences (Alt'Carpo)
- Avoid *lepidoptera* (codling moth, oriental fruit moth, leaf rollers) and *diptera* (Mediterranean fruit fly), but also cockchafer, *Halyomorpha*.
- Efficacy is variable from one situation to another and needs sometimes to be completed (granulosis virus or/and chemical insecticides). It does not seem to last always in the time.
- Secondary effect : aphids (grey and woolly) may increase
- To help pollination, introduction of bumble bees and wild bees.

# Improve Biodiversity

Laimburg

## Flower strips to promote natural enemies

- Natural enemies are significantly more abundant on trees in the flower strip plots than in the control plots (EcoOrchard project)
- Fruit damage caused by *D. plantaginea* after the second fruit drop were reduced.
- The number of larvae, cocoons and pupae of codling moth dropped.



NRI

## Predator management

- Incidence of pesticides on earwigs : Occasional spraying unlikely to have long term effects, but early summer applications should be avoided.
- A software developed by pcfruit to guide treatment decision, taking into account the presence of sensitive life stages of the earwig life cycle

## Attracting hoverflies to apple orchards

NRI

- Combination of semio-chemicals
- A commercial predator lure ‘Magipal’ developed in a AHDB project

# Introduce macro-organisms

IRTA

## Biological control in netted apple orchards

- Installation of refuges (50 per ha) for predators *(Forfícula auricularia* and *Arachnidae*)
- Three releases of the *coccinelidae* (*Adalia bipunctata*, *Hippodamia coccinelidae, Scymnus* sp., at the amount of 2000 individual of each per hectare in May.
- No control of rosy apple aphids. Only a few predators were observed. Chemical spraying was needed.
- Other angles to work : spray kaolin in autumn to avoid egg laying
- Avoid migration of rosy apple aphids adults by keeping the orchards closed in October, November.

University of Bucuresti

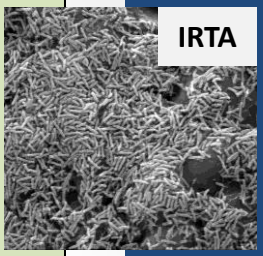

## Using the entomophagous Wasp *Trichogramma evanescens*

- Two applications on first generation: 1st - 120,000 wasps/ha (2-3 days after flight peak) ; 2nd - 12 days later, 130,000 wasps/ha. One application on second generation – 50.000 wasps/ha
- Compared to the control, 50 % less fruits attacked, but level still too high.

# Substitute or complete pesticides

**Alternative compounds**

- **Microscopic BCAs :** *Bacillus thuringiesis, Beauveria bassiana, Cydia pomonella granulovirus, Aureobasidium pullulans*
- **Natural products :** potassium bicarbonates, acid clay, laminarin, plant extracts (*Quassia amara*, *Euquisetum arvense*, *Urtica ssp*., …)
- **Semio-chemicals and attractants** for monitoring, mating disruption, mass trapping
- **Macro-organism :** nematods
- **Plant resistant inducers**





**Physical methods:**

- **Mechanical weeding**
- **Hot water treatments against storage diseases**


ESTEBURG

# Preserve environment

- Adapt doses and spray volumes (crop dependent spraying)
- Adjust spray parameters (air speed and nozzle type)
- Reduce drift: nozzles, hail nets, break wind nets, hedges, « tunnel sprayers », fruiting wall concept.
- Innovative spray application :

* canopy fixed spraying system
* injection or vaccination

- Effluents treatments.

Wageningen

Agroscope

CTIFL

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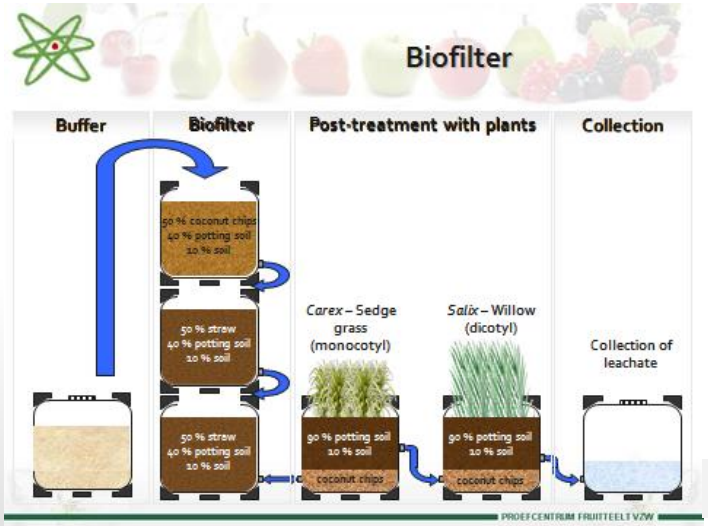


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# Remove residues


- **Studied techniques:**

soaps, hot water, brushes, sodium silicate, Ultrasounds, ozonation, potassium peroxymonosulfate, electrolyzed water

- **Trends:**

- Reduced concentration (between 30 and 50 %, and even more when combined techniques), but same number of residues.
- Difficulties for products with a systemic mode of action.
- Foam formation with soaps.
- Stability limited of the baths concentration to wash fruits.
- Management of detergents effluents.
- Complexity of the process.

# Challenges

- **Reduce chemical treatments**
- **Minimize residues**

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- **Fruit quality**
- **Competitiveness**

⟷

**Increase consumption**

- ✓ Chemicals use has decreased, but alternatives are still missing.
- ✓ One of the main problem are storage diseases, and new pests and diseases continue to emerge.
- ✓ The reduced number of pesticides can develop other pests and diseases.
- ✓ Are resistant varieties the solution? Will they find their place on the market?
- ✓ Be aware of the costs to reduce chemicals and residues and the final fruit sale price.

**An European research network to contribute to innovation**


## EUFRUIT knowledge platform :
## http://kp.eufrin.eu


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