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Protection strategies and techniques studied in Europe to minimize residues on fruits

EUFRIN Working Group :

« Sustainable fruit production to minimize residues »

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"Sustainable fruit production to minimize residues"

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Context

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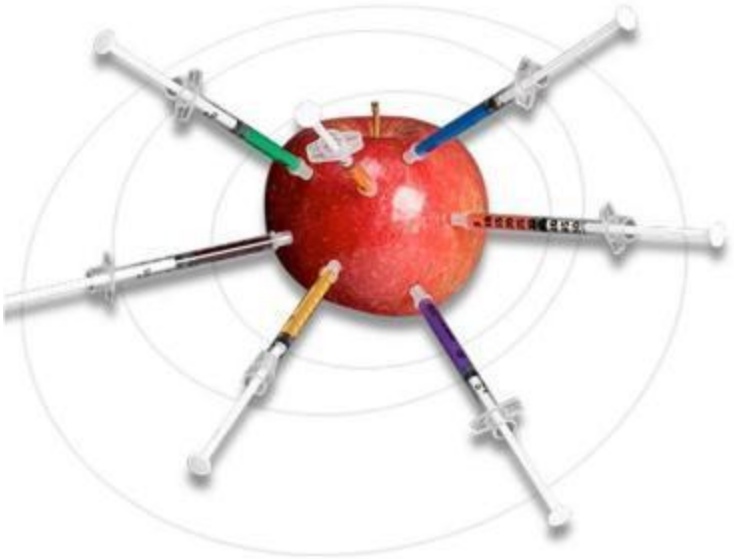
- use of pesticides is less and less accepted in our **society**.
- **producers** have more and more difficulties to protect their crops against pests
- **retailers** have more and more restrictive guidelines for selling fruits and vegetables



GREENPEACE

Mouvement pour le droit et le respect des générations futures - MDRGF

Pesticides, first risk in food chain for Europeans

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- June 2010 : Survey realised by the European agency for food safety (26.691 persons).

To which potential risks do you think you are exposed ?

1° : economic crisis

2° : pollution

3° : sickness

4° : food risk

- **In France :**

80 % residues on fruits, vegetables & cereals,
80 % Mercury and dioxin, 72 % cloned animals,
65 % poisoning by bacteria, 64 % GMO,
52 % nanotechnologies, 46 % allergies, 40 % mad cow crisis

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Retailer requirements

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Retailer	*Product/Label*	Request 2009
COOP	*Marchio COOP*	Max 30% single MRL, max 100% sum of MRL
ESSELUNGA	*Naturama*	Max 30% single MRL, max 40% sum of MRL
LIDL		Max 33% single MRL plus Global GAP
ASPIAG	*Passo dopo Passo*	Max 30% single MRL, max 100% sum of MRL
BILLA	*Fior di Spesa*	Max 30% sum of MRL
KAUFLAND		Max 33% single MRL, max 100% sum of ARfD
KAISER'S TENGELMANN		Max 70% single MRL, max 70% single ARfD
AUCHAN		Max 50% single MRL
CRAI		Max 50% single MRL, max 100% sum of MRL
EDEKA	*Rio Grande / Yacaran*	Max 50% single MRL / a.s. proposed by EDEKA
CONAD	*PQC*	Max 50% single MRL, max 100% sum of MRL
GRUPPO SELEX	*Marchio SELEX*	Max 50% single MRL
CARREFOUR/GS	*Filiera/FQC/Viversano*	Max 50% single MRL
TEGUT		Max 70% single MRL, max 70% single ARfD, max 4 a.s.
DOHLE-HIT		Max 70% single MRL, max 70% single ARfD, max 4 a.s.
ALDI		Max 70% single MRL, max 80% sum of MRL, max 80% sum of ARfD, max 4 a.s.
HOFER		Max 70% single MRL, max 80% sum of MRL, max 80% sum of ARfD, max 4 a.s.
REWE		Max 70% single MRL
ORTOFIN	*PQI PQU*	No post-harvest treatments (Some a.s. derogated)
TESCO	*Tesco*	List of a.s. (Tesco list of PPPL) + TNC

Source WAPA

An European working group

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- **What is EUFRIN ?** A place of exchange of experiences with the aim to mutualise the research on a given theme.
- **Why a new WG in 2008 ?**

  The « zero residues », a common problem.

- **15 countries actually :** Austria, Belgium, Denmark, France, Germany, Italy, Netherland, Norway, Romania, Poland, Slovenia, Spain, Sweden, Switzerland, UK.
- **Technical partners:** research stations, universities, technical institutes.

Working group members

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Austria– Versuchstation für Obst und Weinbau (Haidegg)

Belgium – Pcfruit Kerkom

Denmark – Aarhus University

France - Ctifl

Germany – ESTEBURG – Obstbauzentrum Jork

Italy – Univ. de Bologna ; Obstbau Versuchszent. Laimburg

Netherlands – Applied Plant Research (Randwijk, Wageningen UR)

Norway – Institut pour la recherche agronomique et envir. (Bioforsk)

Poland – Research institute of pomology and floriculture (Skierniewice)

Romania – Univ. of Agronomic sciences and veterinary medicine (Bucarest)

Slovenia – Faculty of Agriculture and Life Sciences (Maribor)

Spain – IRTA (Catalonia)

Sweden – Univserity of Agricultural Sciences (Alnarp)

Switzerland – Research station Agroscope ACW (Wädenswil)

UK – East Malling Research station

Comparison of strategies to reduce residues

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- **In an experimental orchard :**

  ex. Agroscope ACW :

  « Low-Input apple production » trial

  ex. ESTEBURG – Obstbauzentrum Jork :

  « Long term strategy » trial

- **In a network of commercial orchards :**

  ex. Fruit.Net (Catalonia)

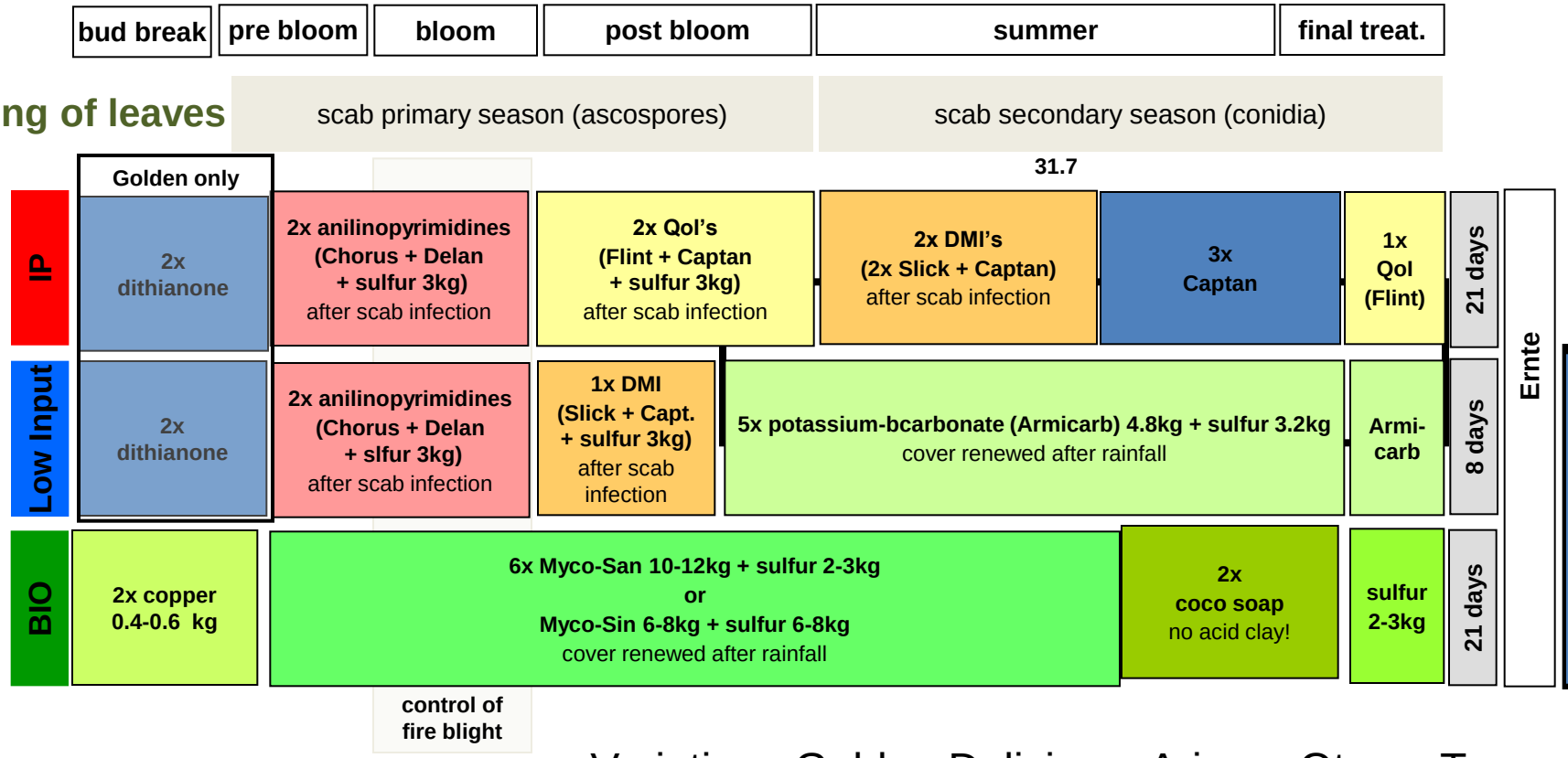
  ex. pcfruit (Belgium)

  ex. East Malling Research (UK).

The main principles

- Limit or even stop "chemical“ treatments from “petal fall” by developing the use of "alternative” products on the secondary contaminations of apple scab or on rising population of codling moth during summer time.
- Choose pesticides according to their eco-toxicity.
- Increase the harvest interval.
- Study autumnal spray application strategies (aphids, apple scab)
- Promote mating disruption, mass trapping, enclosure netting, preventive measures in autumn, mechanical thinning.
- Lean on decision-making tools (evaluation of the risk and simulation by models)

Low – Input apple production trial (Wädenswil) 2010 strategy example



Exclosure netting !

Varieties : Golden Delicious, Ariane, Otava, Topaz

Strategy	Aphids	Codling moth	Smaller fruit tortix (Golden Del. only)	Weed control	thinning
IP	1x triazamate (Aztec) ahead of bloom	Mating disruption	1x fenoxycarb (Insegar) (3. June)	Herbicides	Chemical thinning
Low-Input					
Bio	1x azadichratin A (Neem Azal) ahead of bloom		1x audienz (Spinosad) (10. June)	Mechanical weeding	Mechanical thinning (Darwin)

ESTEBURG
OBSTBAUZENTRUM JORK

OVR

Long-term strategy trial 2009-2014

number	strategy	description
1	No insecticides; no fungicides from BBCH 74 onwards	• **no** insecticides after blossom • fungicides application stop BBCH 74 (mildew fungicides until shoot growth stops)
2	No fungicides from BBCH 74 onwards	• fungicides application stop BBCH 74 (mildew fungicides until shoot growth stops) • integrated pest control
3	Ecological plant protection starting mid July	• integrated plant protection (fungicides) until mid July, afterwards ecological products only • ecological insecticides after
4	Precaution	• preventive plant protection until BBCH 70 • no residual relevant pesticides after blossom, starting in summer use of ecological pesticides only
5	Standard without storage fungicides	• integrated plant protection • Captan containing storage fungicides only
6	**Standard**	• **integrated plant protection**
7	Standard + fruit mummies removed	• integrated plant protection • fruit mummies removed before bud break
8	Anti-resistance	• integrated plant protection • resistance management optimized

Variety : Elstar

Key points : efficiency levels & consequences

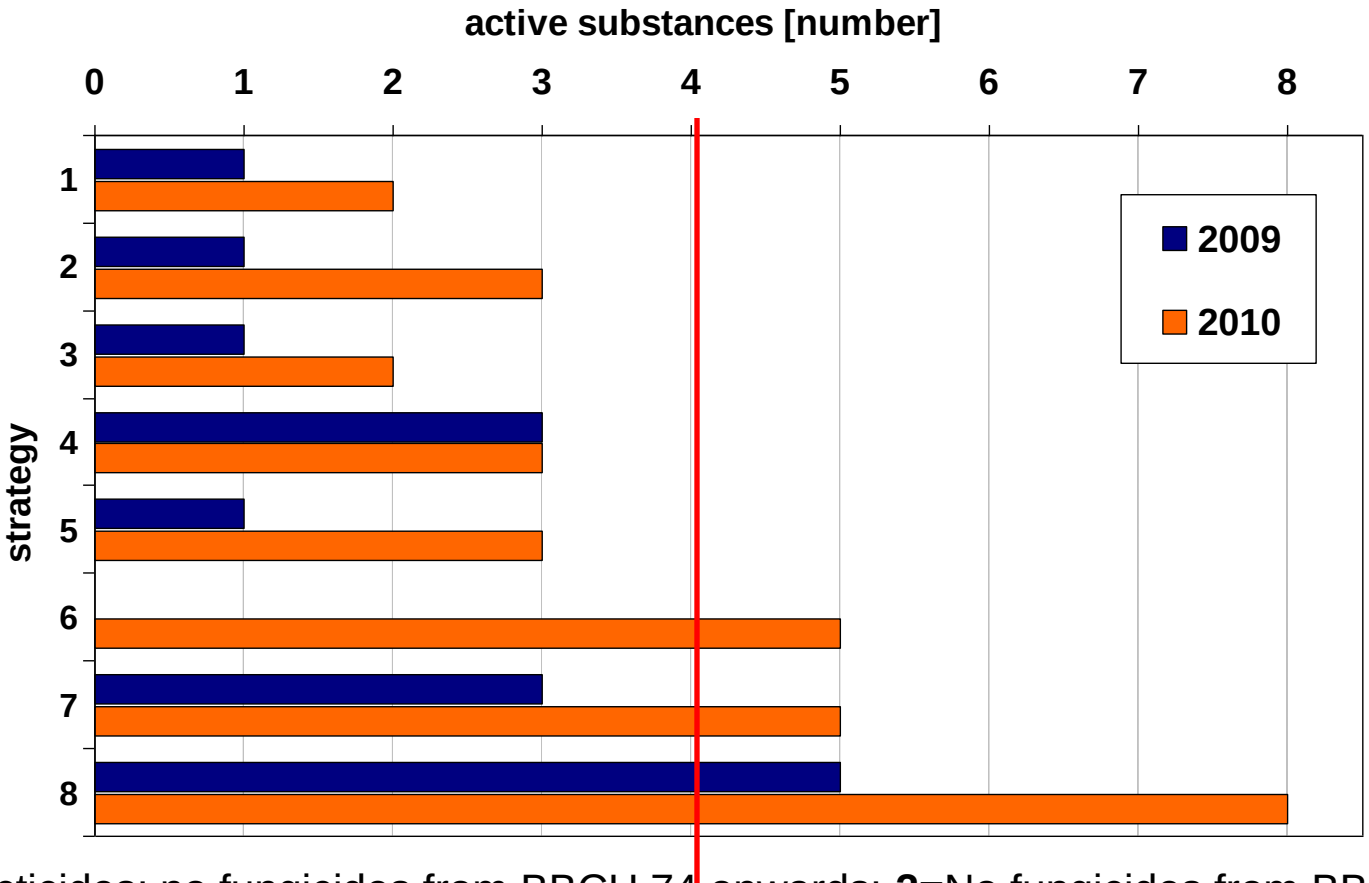
- Good control on **apple scab & powdery mildew** with potassium bicarbonate + sulphur in secondary contamination period. (e.g. in Wädenswil in 2009 and 2010).
- Strategies without **storage disease** control present the highest losses. (e.g. in Jork, symptoms mid - December up to 50 % on Elstar)
- Hot water treatments against **Bull's eye rot** at storage on Golden and Topaz helps to reduce the damages.

  (e.g. in Wädenswil)
- Appearance or development of **other bio-aggressors**.

  (e.g. premature leave fall on Topaz and Otava in the low input trial in Wädenswil).
- Increase of the protection **costs** in the program with limited residues (e.g. in Jork, strategy 3 and 7)

Pesticides reduction

- From July, treatments with more "ecological" profiles, reduce the detected number of active substances at harvest (e.g. to Jork < 4 a.s).



1=No insecticides; no fungicides from BBCH 74 onwards; **2=**No fungicides from BBCH 74 onwards; **3=**Ecological plant protection starting mid July; **4=**Precaution; **5=**Standard without storage fungicides; **6=Standard;** **7=**Standard + fruit mummies removed; **8=**Anti-resistance

Fruit.Net project Catalonia

<u>The project includes all the fruit chain, from pre to postharvest, in order to control all possible pests, diseases and disorders</u>

<u>Aim</u> : optimizing the use of pesticides and residues minimization along the fruit production

- Develop techniques and alternative systems
- Transfer to the end users
- Integrate all actors : Agriculture department, IRTA, universities and fruit sector

The project works in apple, pears and peaches.

There are 3 technical committees (apple, pear and peaches) who organize the project with scientists and advisers of public and private sector.

Fruit.Net project Catalonia

Research activities (examples):

- Control of Thrips in peaches using biological control and natural products.
- Control of *Monilinia* spp in peaches using a forecasting model and several cultural strategies (as inoculums reduction, calcium application,…).
- Control of main postharvest diseases in apples using biological control.
- Control of postharvest apple scald using dynamic atmosphere.

Validation activities

- This year includes 14 apple and 13 peaches commercial orchards
- In the period 2009-2010 :

  18 % and 25 % reduction for the fungicides

  and from 28 to 30 % reduction for the codling moth insecticides (Pom.Net orchards, now included in Fruit.net project)

Research to become residue poor fruits

Aim : residues management as instrument for food-safety but with respect for economic profitable and durable fruit production.

- Determination of pre-harvest interval
- Spray schedules to limit residues according to retailers
- Spray schedules to limit residues according to specific markets (e.g. Russia)
- Develop alternative control methods to avoid residues.

Example of advices for fungicides (2009 – 2010)

- dithianon : max 3 sprays between 20/6 and 44 days before harvest at max. dose of 500g/ha
- thiram : PHI 35 d
- captan : PHI 105 d
- thiofanaat-methyl (Topsin M) : no use after 1 July
- Bellis : max. 2 sprays against storage diseases PHI 7d
- Switch : max. 2 sprays with PHI 7d
- trifloxystrobin (Flint): PHI 28d
- triadimenol (Exact) : PHI 28d

➔ other fungicides can be used as in the past with respecting legal PHI

What incidence on residues with a "fungicides – leaf fertilizers" mixture near harvest ?

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Research Topics

- **Sanitation** to reduce scab inoculum (leaf shredding - removal, *Cladosporium cladosporioïdes*, fungicides before leaf drop)
- **Bio-control** solution in orchard :
  mating disruption, potassium bicarbonate,
  induced resistance (e.g.laminarine),
  biological control agents (e.g.nematodes)

- **Natural products** to control storage diseases : yeast
- **Physical methods** : UV, Hot water, thermal pest control

Looking for innovative methods

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Principle :

plastic rain protection used on sherries on the row under the hail nets.

Arrangement :

- Two bands of 1.40 m wide
- Inter – rank not covered
- Variety Braeburn

Rain protection trial : apple scab results 2010

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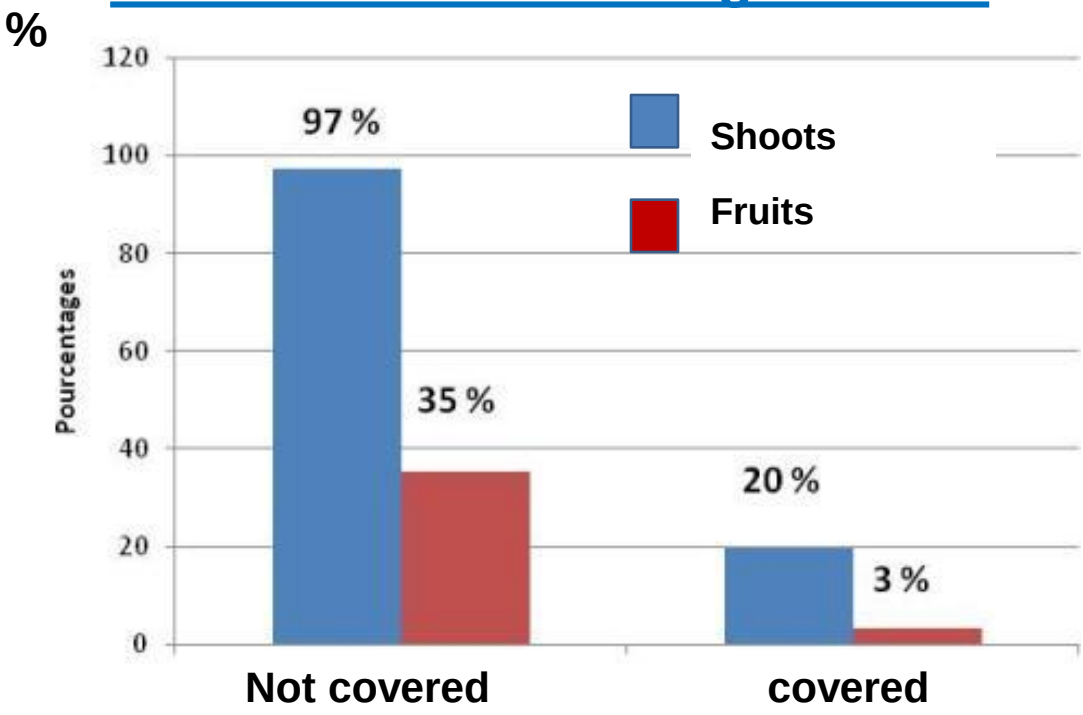
At the end of the primary contamination in 2010 :

Not covered : 22 % of the shoots and 8.7 % on fruits

Covered : 0,7 % of the shoots and 0% on fruits.

Evaluation at mid - august 2010 :



Difficulties in 2010

- Inadequate joint on the top of the trees
- Late installation (in April 6th): ¼ of the apple scab projection

Rain protection trial : apple scab results 2011

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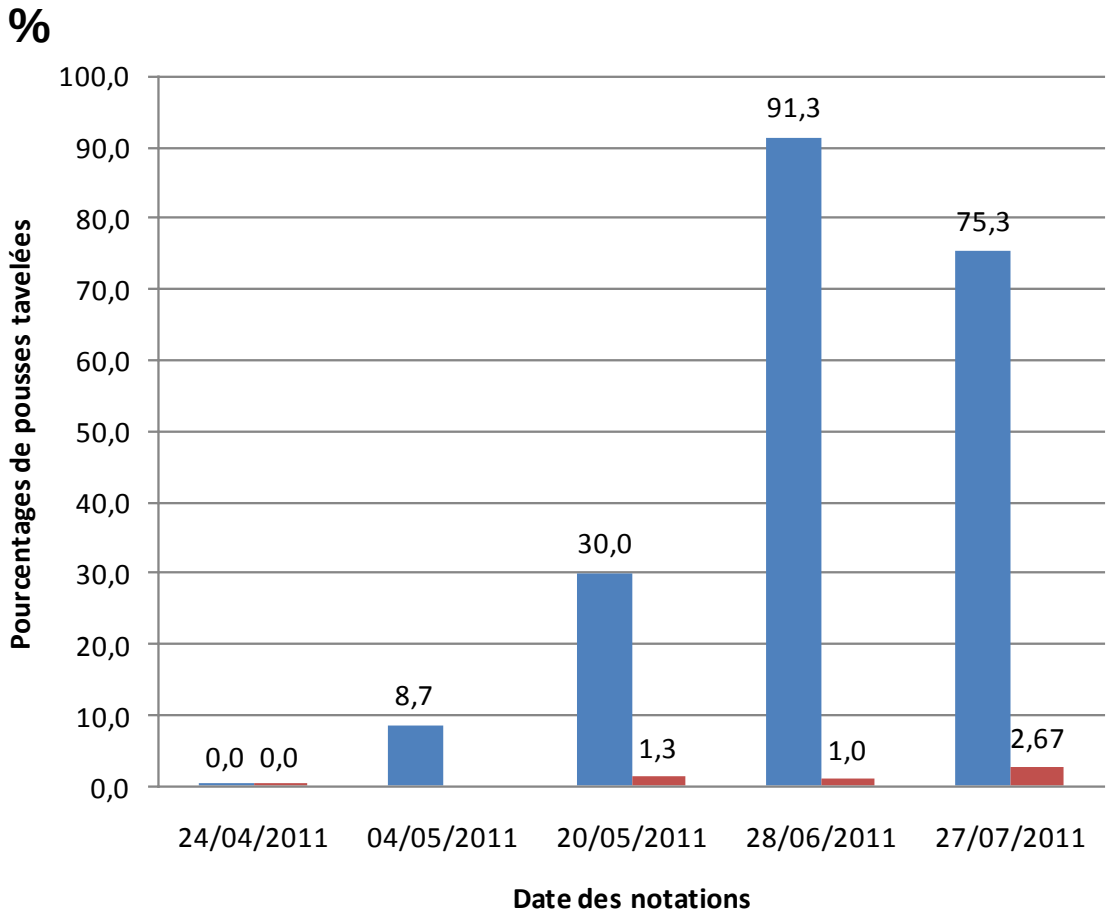

End of July :
7 % of the non covered fruits have apple scab.
No fruit is damaged under the rain protection.

Nets against codling moth

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- **2005 :** elaboration of the “Alt’Carpo” concept located on the rows (by CA 84)
- **2006 :** adaptation to orchards with hail-nets (“door” or “curtain” system).

Source JL. Sagnes CA82

Source JL. Sagnes CA82

Source JL. Sagnes CA82

Aims of the mechanical protection with nets

- Less treatments.
- Protect the varieties with a “high” value potential.
- In organic orchards having a granulosis virus resistance.
- On plots fare away from the farm.
- Reduce the problems of drift near houses.
- For the image of the apple.
- In answer to the retailer demands to minimize residues.
- A protection against birds.

Different situations in France

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In 2009, around 200 ha in South East (3 codling moth generations), 100 in South West (2 generations) and 10 in Loire Valley (2 generation).

- Depending of the pressure, no insecticides, no mating disruption, when closed before the first generation (at the end of flowering).
- The first generation may be protected by 2 or 3 insecticides or even the second generation when damages on fruits.
- Nets on rows more efficient when high pressure than enclosed orchards.
- 4 x 4 stitches on the sides and the top of the orchards or hail-nets on the top.
- Some few damages (other *Tortrix* like C*ydia molesta)* but in global good efficiency level against codling moth..

Incidence of mechanical protection in two trials (Gala and Braeburn) Ctifl Center of Lanxade

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Flowering & Fructification :

Introduction of bumblebees

- 2009 : no significant difference for both varieties.
- 2010 : a better flower level for Gala with nets. No significant difference for the fructification. No difference for Braeburn.

Production :

- 2009 : a difference for Braeburn with a higher yield under nets (more fruits, bigger calibre).
- 2010 : no difference for both varieties.
- 2009 & 2010 : no difference for the sugar level, acidity and firmness.

The Austrian and Swiss experiences with enclosure netting


L. Steinbauer


L. Steinbauer

- Arrangements in Steiermark :
  Side nets buried in the ground (game)
  door system to open the orchard
- Hail nets closed by pink bud until harvest and introduction from 1 to 3 hives / hectare
- Later detection of the fire blight and a grouped attack (e.g. Steiermark).
  Even a less pressure (e.g. Wädenswil) ***Nets = Brake ?***


L. Steinbauer

- Encouraging results, but damages with leaf rollers and smaller fruit trotrix.
  Where do they come from ?
- Barrier to other "bio-aggressors" :
  e.g. cockchafer (Wädenswil),
  *Hamonia oxyrides (*Steiermark)
  and birds.

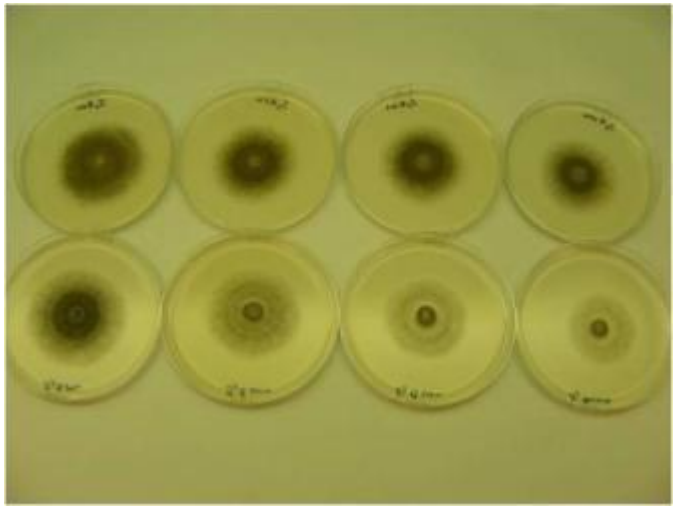
APPLIED PLANT RESEARCH
WAGENINGEN UR

Treatments with UV against fungi's ?

- Works done in Petri dishes
- Study the anti-germinal and inhibitive action on the mycelia growth of *Botrytis, Colletotrichum, Rhizopus, Penicillium, Venturia, Alternaria*.

example on Botrytis :

UV-C effect of 0, 5, 10, 25, 50, 100, 200 and 400 mJ/cm^2 - 3x irradiated



- **Results :**

- possible superficial "disinfection" of fruits,
- short-term effect (back after 48 - 96 hours),
- requires to repeat the irradiations.

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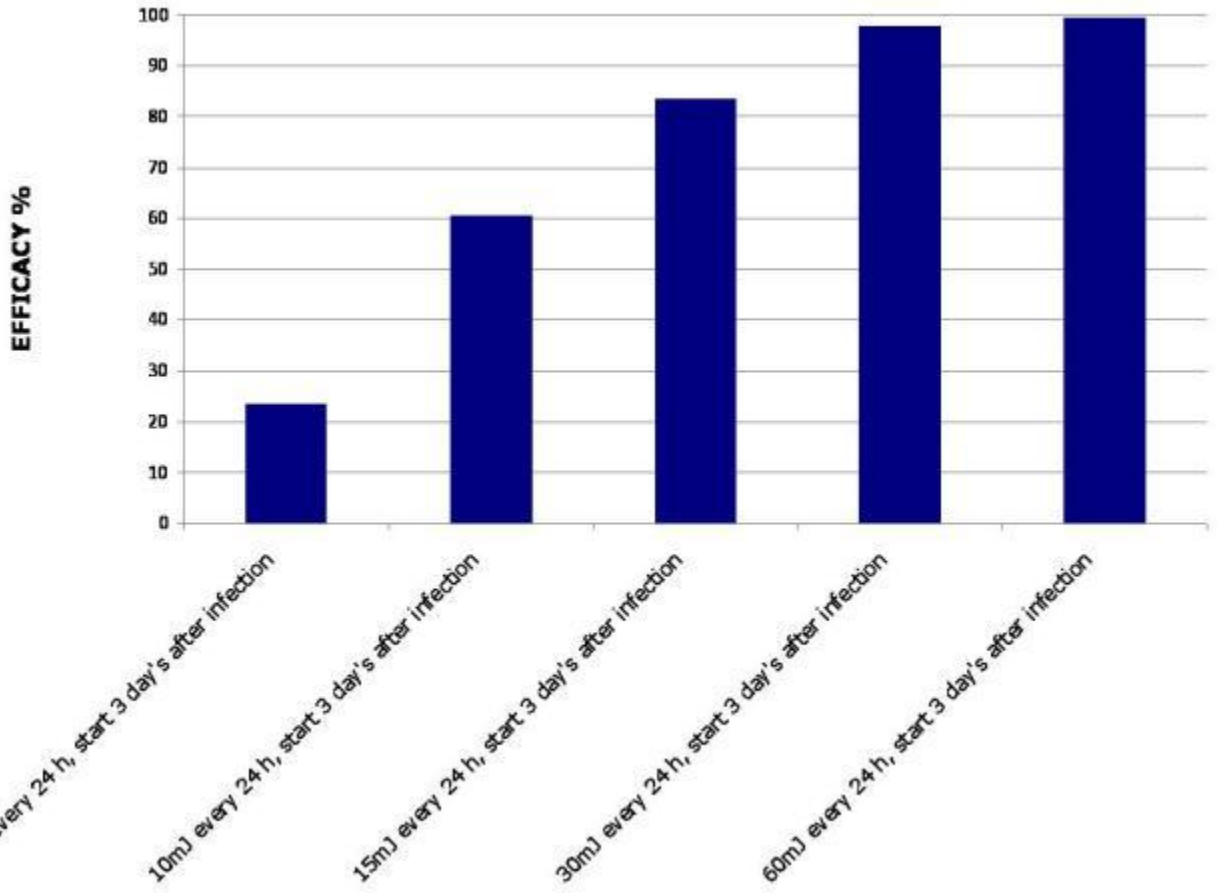
Powdery Mildew control by UV-C on strawberries



What can be done in packing house ?

- **<u>Ozonation</u> (Wageningen):**
  - Efficiency in the water, but not on fruits
  - Combination with soaps : 60 % of reduction of the concentration
  - **Inconveniences :** long process, the *number* of residues stays the same, no systematic effect, costs.

- **<u>Soaps</u> (Wageningen and Jork):**
  - Concentration reduced by 30 to 50 %
  - No effect noticed after brushing the fruits
  - **Inconveniences :** management of the foam, the stability of the concentration in the prepared soap, management of the remainder effluent, the final wash with tap water.

- **<u>Others</u> :** Sucrose ester, Salts or warm water

CONCLUSION - PERSPECTIVES

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- A lot of work has be done, but there is still a lot to do
- Elaborate an European “data-basis” about the bio-control solutions to develop them in different countries and achieve a harmonization for their registration.
- Build up common studies to exchange protocols, results and conclusions.
- Achieve the transfer to commercial fruit production.

If you are interested, please contact us.