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Eufrin working group - Sustainable fruit production to minimize residues

Combine methods from European research to reduce residues

We are living in a society in which there is a growing aversion to chemicals on fruit and vegetables. Wide-scale European research among the citizens showed that residue on fruit and vegetables is seen as the fourth largest threat, after the economic crisis, environmental pollution and disease. In part because of this, supermarkets are placing more stringent requirements on residues than required by the legislation, with the focus on the number of different residues and their concentration, for instance, 50% or 30% of the Maximum Residue Limit (MRL).

Nowadays, supermarket chains promote themselves as suppliers of fruit and vegetables containing the least amount of residue. In this situation, where there are requirements related to the number of residues, growers are finding it increasingly difficult to successfully control pests and diseases. The working group *Sustainable fruit production to minimize residues* of the European Fruit Research Institute Network (Eufrin) has set itself the objective of combining various residue reduction strategies into a feasible system for growers, in which production volumes and fruit quality are retained. Franziska Zavagli, coordinator of this Eufrin working group, explained this in more detail during the meeting of all the Eufrin working groups that was held in parallel to Interpoma 2012.

The main principles of the strategy

The strategy, as drawn up by the Eufrin working group to minimize residue on fruit while retaining production levels and fruit quality, has the following main principles:

Full netting can limit the use of insecticides.
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- Use pheromone mating disruption as the basis for crop protection. This means that fewer chemicals need to be sprayed, as fewer secondary pests appear.
- Up to the blossoming period, employ a regular spraying schedule and then take as many alternative measures as possible. Two examples are: 1) From full bloom up to and including harvest, use as many organic products as possible to control scab. 2) Only use crop protection products – preferably organic products – to control codling moth to complement pheromone mating disruption when the risk of infection peaks.
- When chemical products are used, use them at the right moment based on a decision-support model. When deciding on the product, take account of the environmental effect per product.
- Where necessary, extend the time to the harvest per product to reduce residues.
- Use after-harvest techniques, for instance, to control scab and aphids.
- Take preventive measures, including the mass capture of insects and full net cover.

Info

Eufrin working group
As a response to the then increasingly louder calls to meet the need for fruit without residues, the Eufrin working group *Sustainable fruit production to minimize residues* was established in 2008. The objective is to work together to meet the need for fewer residues, financed by funds from each country. Currently, fifteen countries within the EU are voluntarily working together, these countries are: Austria, Belgium, Denmark, France, Germany, Italy, the Netherlands, Norway, Romania, Poland, Slovenia, Spain, Sweden, Switzerland and Great Britain.

Franziska Zavagli is the coordinator of the Eufrin working group Sustainable fruit production to minimize residues. *EFM*

- Use mechanical thinning as part of the total thinning strategy.

Results of European research

Researchers at the Swiss research station Agroscope Changins-Wädenswil (ACW) have carried out a trial to compare an Integrated Pest Management (IPM) scheme, a low-residue scheme and an organic scheme. The various strategies are shown in Table 1.

The most important conclusion from the ACW research is that scab can be quite effectively controlled using potassium bicarbonate. After treatment with bicarbonate from 2009 up to and including 2011, less than 1% of the fruit was infected with scab. In 2012, scab pressure was very high. In the control batch, 96% of the fruit had scab, while only 2% of the treated fruit were infected.

Long-term research at the Esteburg research station in Jork (Germany) showed that after being stored, Elstar apples, which had only be treated with Captan in the pre-harvest spraying schedule, could suffer from 50% rot. The ACW research showed that this can in part be prevented by a post harvest hot water treatment.

Pheromone mating disruption must form the basis of crop protection. This means that fewer chemicals need to be sprayed, as fewer secondary pests appear. *EFM*

The Esteburg research station concluded that growing residue-free fruit increased production costs and the risk of loss due to rot. In addition to the current measures, more is needed to reduce the current percentage of rot. The Esteburg research clearly shows that if a scheme is used that avoids the risk of resistance developing, it is impossible to meet the supermarket requirement of a maximum of four different residues (see Figure 1), which is more stringent than the statutory requirement.

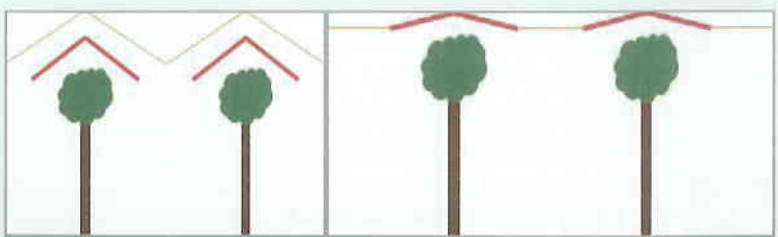
Removing residue

In addition to preventing residue, it is also possible to partially remove residue after the fruit has been stored. This is shown by research carried out by Applied Plant Research (PPO Fruit) in Randwijk (the Netherlands), the Esteburg research station in Jork (Germany) and Ctifl (France). Residue can be removed during grading by using soap, brushes and hot water. Dependent on the active ingredi-

Innovation

Rain covers, which are usually used in cherry production, have been used in a trial to reduce the number of scab infections in apple. This was a comparative trial, in which the fruit received no other treatment to control scab. The trial showed that there was a strong reduction in the number of shoots and fruits suffering from scab when rain covers were used. For good preventive efficacy, the rain covers must be installed by the beginning of March.

Rain covers offer good protection against scab, as long as they are installed in such a way that the rainwater does not drip onto the crop. It is an expensive investment. When rain covers are combined with anti-hail nets, the costs (anti-hail nets including plastic cover) are € 1,000 per hectare per year more than when apples are produced under hail nets and a comprehensive scab treatment scheme (costs of hail nets plus chemical control) is used. "When the rain covers are compared to only chemical scab control, the costs are eight times as high", says Franziska Zavagli, researcher at the French research institute Ctifl.



Two possible combinations of rain covers (red) and hail nets (yellow) used during the scab season to reduce the chance of infection. *EFM*

Requirements more stringent than the statutory requirements

When a crop protection scheme is used that takes account of resistance management, it is infeasible to meet the stringent supermarket requirements with respect to the number of residues. This is shown by research carried out by the Esteburg research station in Jork (Germany). In part based on this finding, the research institutes the Laimburg Research Centre (Italy), KOB-Bavendorf on the Bodensee and Esteburg in Altes Land/Niederelbe (both in Germany) jointly decided to take the lead in warning the government about these supermarket requirements that are more stringent than the statutory requirements. This does not detract from the fact that the fruit sector and the collaborating research institutes in the Eufrin working group *Sustainable fruit production to minimize residues*, will continue to look for ways to optimise integrated fruit production.

The Eufrin working group argues for mechanical thinning as an alternative to chemical thinning. EFM

ent, it is feasible to achieve a reduction of 25 to 89% using cold water and soap. When brushes are also used, 6% more residue can be removed and if hot instead of cold water is used, 10 to 20% more residue can be removed than when only cold water and soap are used. However, this method does not completely remove all active ingredients. The method can help to meet the residue requirements (that are more stringent than the statutory requirement) per chemical, but not the maximum permitted number of active ingredients on a product.

Balance

The Eufrin working group *Sustainable fruit production to minimize residues* is certainly aware that there must be a balance between the additional costs, the reduction of residues and the quality of the fruit. Therefore, more research is required to be able to make the translation, based on research results, to the practical situation. The working group sees a task for itself in doing research into innovation and crop protection with the objective being the implementation in and therefore optimisation of professional fruit production.

Table 1. Example of a low-residue strategy in 2012 for apples, drawn up by the Swiss ACW research station. Varieties: Golden Delicious, Ariane, Otava, Topaz

Disease control

	bud break	pre bloom	bloom	Post bloom	summer	final treat.	
IP	2x Delan	2x Chorus + Delan + S after scab infection		2x Flint + Captan + S after scab infection	2x Score + Captan after scab infection	3x Captan	1x Flint	3 weeks
LR	2x Delan	2x Chorus + Delan + S after scab infection		1x Score + Captan + S	7x Armicarb + S renewed after rainfall		1x Armicarb	8 days
OP	2x Copper	6x Myco-Sin + S			7x Armicarb + S renewed after rainfall		1x Armicarb	8 days

harvest | hot water treatment

Gold. Del. only | control of fire blight | Exclusion netting in all strategies!

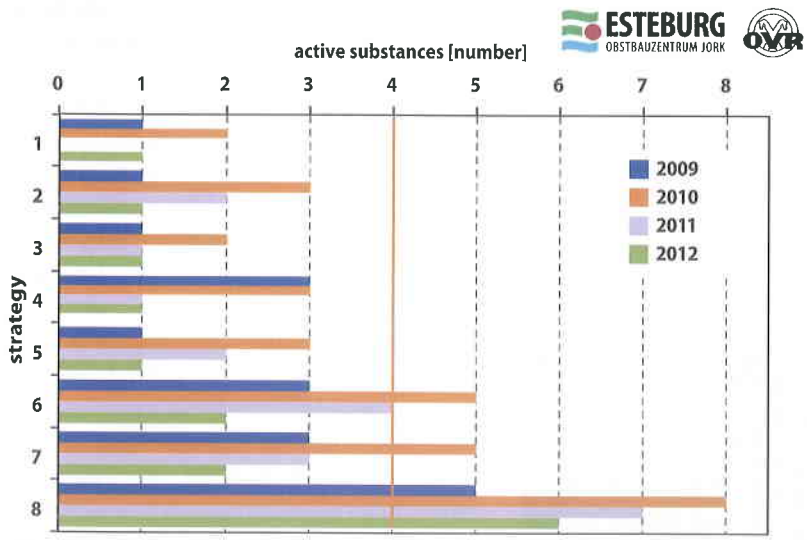
Pest control, weed control, thinning

	aphids	codling moth	smaller fruit tortrix	weed control	thinning
IP	1x triazamate (Aztec) ahead of bloom	mating disruption	1x fenoxycarb (Insegar) end of May	herbicides	Chemical thinning
LR					
OP	1x azadichratin A (Neem Azal) ahead of bloom		1x spinosad (Audienz) end of May	mechanical weeding	mechanical thinning (Darwin)

IP: integrated production LR: low pesticide residue management OP: organic production

Source: *ACW*

Figure 1. Number of residues after using various crop protection strategies for Elstar for four years



The strategies 1 through 8 are described in Table 2.
Source: *Esteburg, Jork*

Table 2. Low-residue crop protection in long-term strategies, trial duration: 2009 to 2014

Strategy
1. No insecticides after blossoming and a halt to the application of fungicide after the BBCH 74 / T-stage (mildew fungicides until the shoots stop growing).
2. No fungicide applied after BBCH 74 (mildew fungicides until shoots stop growing), plus integrated pest control.
3. Integrated crop protection (fungicides) until mid July, after that only organic products. After July, ecological insecticides.
4. Preventive measures until BBCH 70. No pesticides that possibly pose a risk to the product. After blossoming, from the summer, only ecological pesticides.
5. Standard integrated crop protection. Only fungicides that include Captan as the active ingredient to combat storage diseases.
6. Integrated crop protection.
7. Integrated crop protection. Additional measure: removing fruit mummies before bud break.
8. Integrated crop protection with optimum resistance management.

Source: *Esteburg, Jork*