Trends and evolutions in pest and disease management in Belgian fruit production

Dany Bylemans, General Assembly Belplant, 16 May 2023

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Why do we need crop protection in fruit production?

Only the perfect fruit results in an income (sometimes) exceeding the production cost

Trend 1: Consumer's concerns: How to deal with risks?

Zero risk doesn't exist.
In no aspect of our life or our business.
Not in food production. Not in plant protection.
The question is: which risk do we accept?

Can’t we solve everything with resistent varieties?

No ! (unless we can make use of gene editing)

< Natyra scab resistant apple

Souvignier gris piwi grape >

Hurdles for introduction:

- Lower production volumes
- Less appreciated by consumers
- Less storable, less shelf life
- Higher sensitivity for other diseases (storage rot, …)
- Breaking of the resistance

Green Deal:

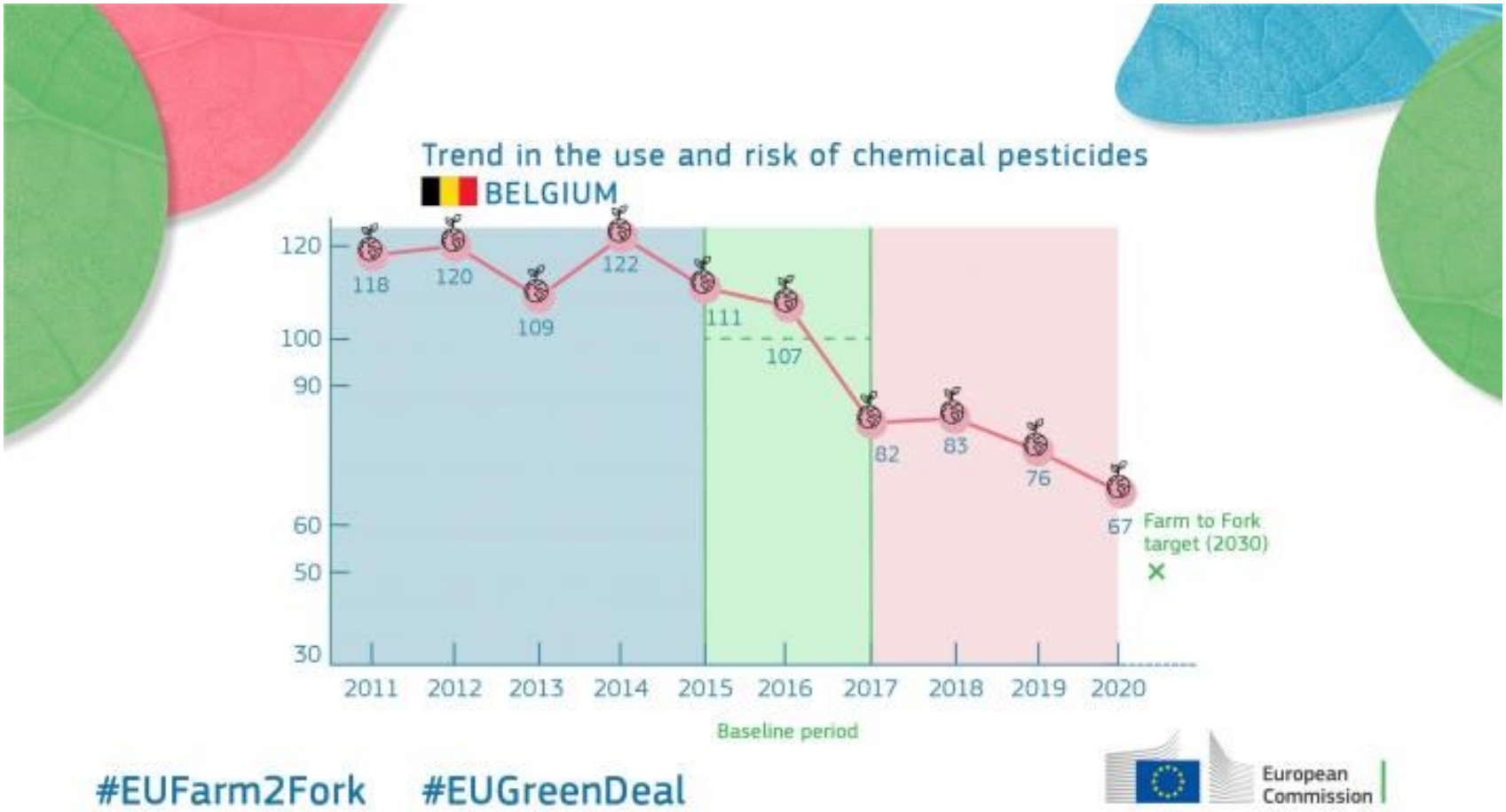
(Reduce by 50% the use of pesticides by the year 2030)

Reduce by 50% the impact of pesticides by the year 2030.

Table 1. Categorisation of active substances and weightings for the purpose of calculating Harmonised Risk Indicators 1 and 2

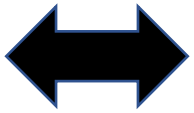
Row	Groups						
	1		2		3		4
(i)	Low-risk active substances which are approved or deemed to be approved under Article 22 of Regulation (EC) No 1107/2009, and which are listed in Part D of the Annex to Regulation (EU) No 540/2011		Active substances approved or deemed to be approved under Regulation (EC) No 1107/2009, and not falling in other categories, and which are listed in Parts A and B of the Annex to Regulation (EU) No 540/2011		Active substances approved or deemed to be approved under Article 24 of Regulation (EC) No 1107/2009, which are candidates for substitution, and which are listed in Part E of the Annex to Regulation (EU) No 540/2011		Active substances which are not approved under Regulation (EC) No 1107/2009, and therefore which are not listed in the Annex to Regulation (EU) No 540/2011
(ii)	Categories						
(iii)	A	B	C	D	E	F	G
(iv)	Micro-organisms	Chemical active substances	Micro-organisms	Chemical active substances	Which are not classified as: Carcinogenic Category 1A or 1B **and/or** Toxic for Reproduction Category 1A or 1B **and/or** Endocrine disruptors	Which are classified as: Carcinogenic Category 1A or 1B **and/or** Toxic for Reproduction Category 1A or 1B **and/or** Endocrine disruptors, where exposure of humans is negligible	
(v)	Weightings applicable to quantities of active substances placed on the market in products authorised under Regulation (EC) No 1107/2009						
(vi)	1		8		16		64

Facts versus perception



Jean and Françoise are not acting consistently, depending on their role !

citizen

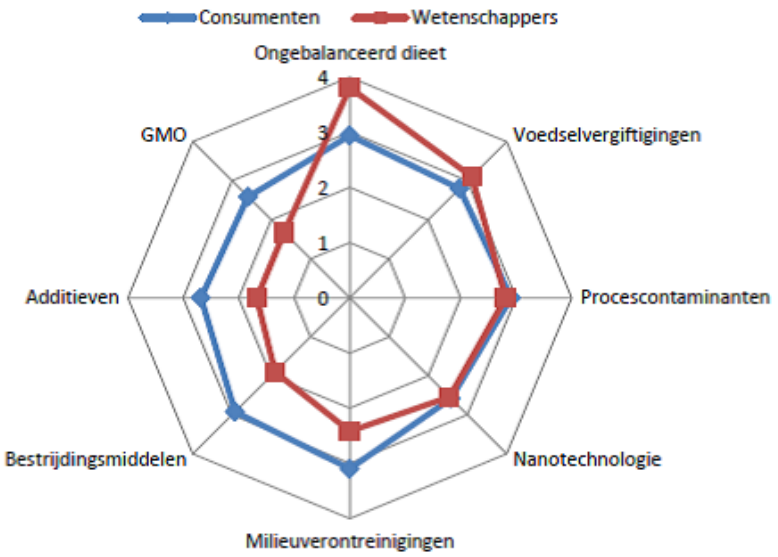


consumer

Solution : communication & information

Perception of consumer is completely different from perception of scientists

Figuur 4.2 Inschatting verschillende risico's voor de voedselveiligheid en volksgezondheid door consumenten en wetenschappers



Toelichting: Voedselvergiftiging = voedselvergiftiging door bijvoorbeeld onzorgvuldig bewaren en bereiden van voedsel; Ongebalanceerd dieet = ongebalanceerd voedingspatroon (veel calorieën, veel zout, veel tussendoortjes); Bestrijdingsmiddelen = resten van bestrijdingsmiddelen op groenten en fruit; Milieuverontreinigingen = milieuverontreinigingen in voeding zoals dioxines, pcb's, zware metalen; Procescontaminanten = bij bereiding ontstane giftstoffen in voedingsmiddelen, bijvoorbeeld in verbrand barbecuevlees, te bruine patat; gmo = genetische gemanipuleerde voedingsmiddelen; Additieven = E-nummers, toevoegingen zoals kleur- en smaakstoffen, conserveringsmiddelen; Nanotechnologie=gebruik van nanotechnologie in voedingsmiddelen en/of de verpakking van voedingsmiddelen. Op de scoreschaal staat 1 voor 'geen risico voor mijn gezondheid' en 5 voor 'zeer groot risico voor mijn gezondheid'.
Bron: Peters et al. (2009).

Trend 2: Procession of Echternach due to invasive species

Martin Hauser, California Department of Food and Agriculture.

Sean McCann, Simon Fraser Univ., USB

Biobest, Belgium

Case : The spotted wing Drosophila – *Drosophila suzukii*

Egg deposition in ripening fruit

Houston, we have a problem…

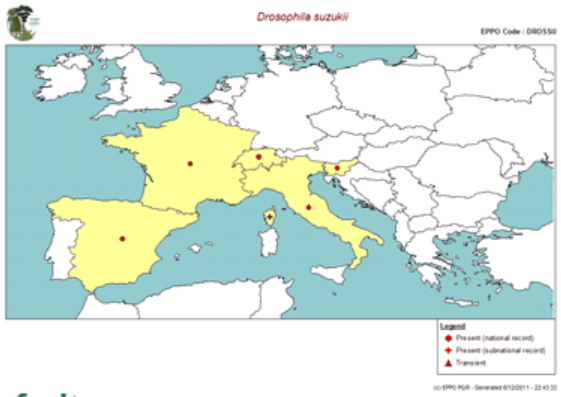
Records noted @ pcfruit:
23 larvae in 1 strawberry (natural infestation)
Estimated populations: 8 million flies in 1 ha cherry orchard


Sean McCann, Simon Fraser Univ., US


@ pcfruit

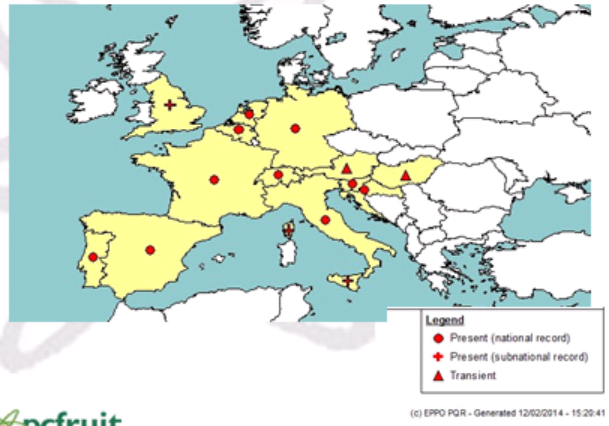
Aziatische fruitvlieg (*Drosophila suzukii*)

Situatie december 2011: eerste detectie in België



Aziatische fruitvlieg (*Drosophila suzukii*)

situatie begin 2014



pcfruit PROEFCENTRUM FRUITTEELT VZW Afdeling Zoölogie 14/02/2014 Studiedag kleinfruitteelt

2008: first observations in California & South-Europa
2011: first observation in Belgium (November)
2012: 26 % of traps caught *D. suzukii*, no damage
2013: 70 % of traps caught *D. suzukii*, no damage
2014: 100 % of traps caught *D. suzukii*, massive damage in berries, cherries, raspberry, blackberry, viticulture and strawberry (open field)
2015+: strongly depending on weather conditions, but every year damage

Toolbox of partial solutions …
(investigated in pcfruit)

Physical control:
- Exclusion netting
- Physcial deterrents
- Mass trapping
- Lure and kill
- Sterile Insect Technology
- Cold chain management
- Modified atmosphere (post harvest)
- Visual distraction

Chemical control:
- Selective compounds
- Broad spectrum compounds

Breeding:
- Resistant varieties

Biological control:
- Predators
- Parasitoids
- Biological control agents
- Natural insecticides
- Pheromone disruption
- Push & pull
- Repellents
- Attractants

Farm management:
- Hygiene measures
- Waste fruit management
- Shorter picking interval
- (Automatic) Monitoring

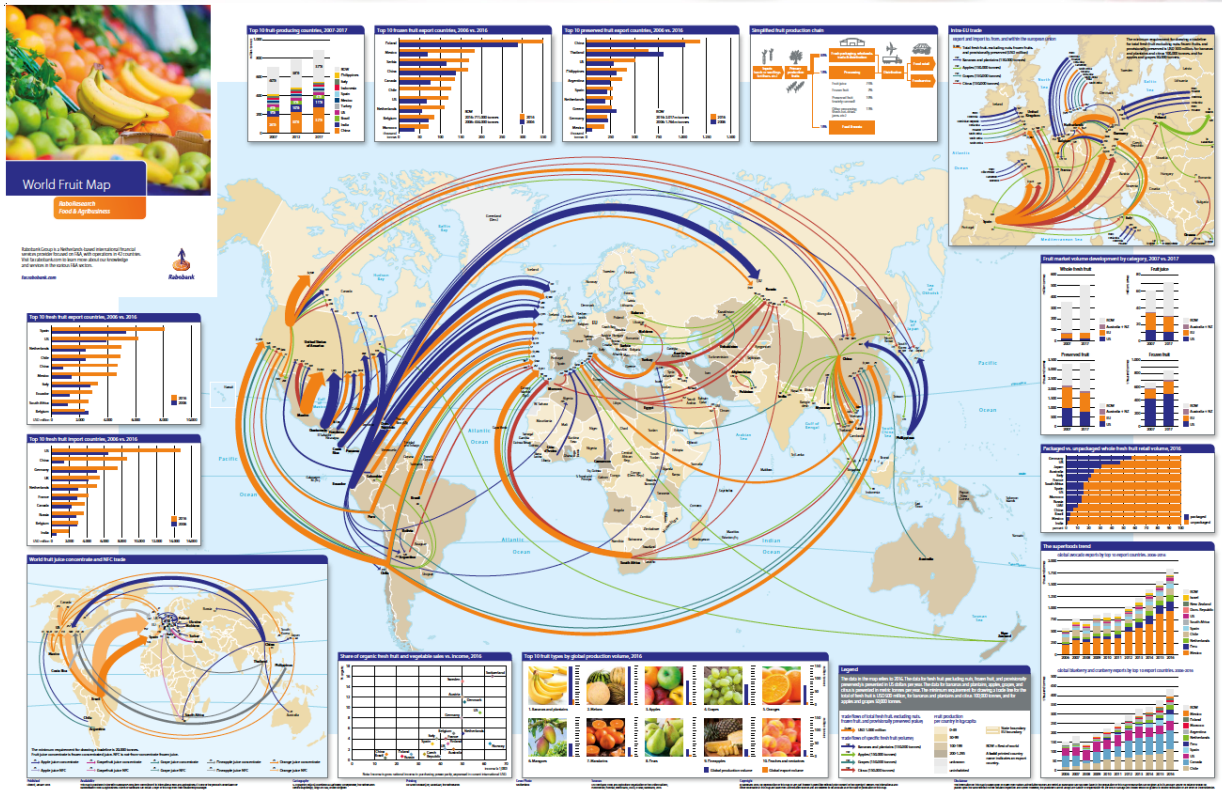
… but the winner is…

➡ *Current IPM under pressure !*

Next one is already there: The brown marmorated stinkbug, *Halyomorpha halys*

Estimated cost Italy: >500 mln €/year

Why this increase in invasive species?



Climate change? Globalised trade ?
Or both ?

Trend 3: IPM today : More with less

3.1. Low risk substances

3.2. Better predictions of risk

3.3 Precision application of PPP's

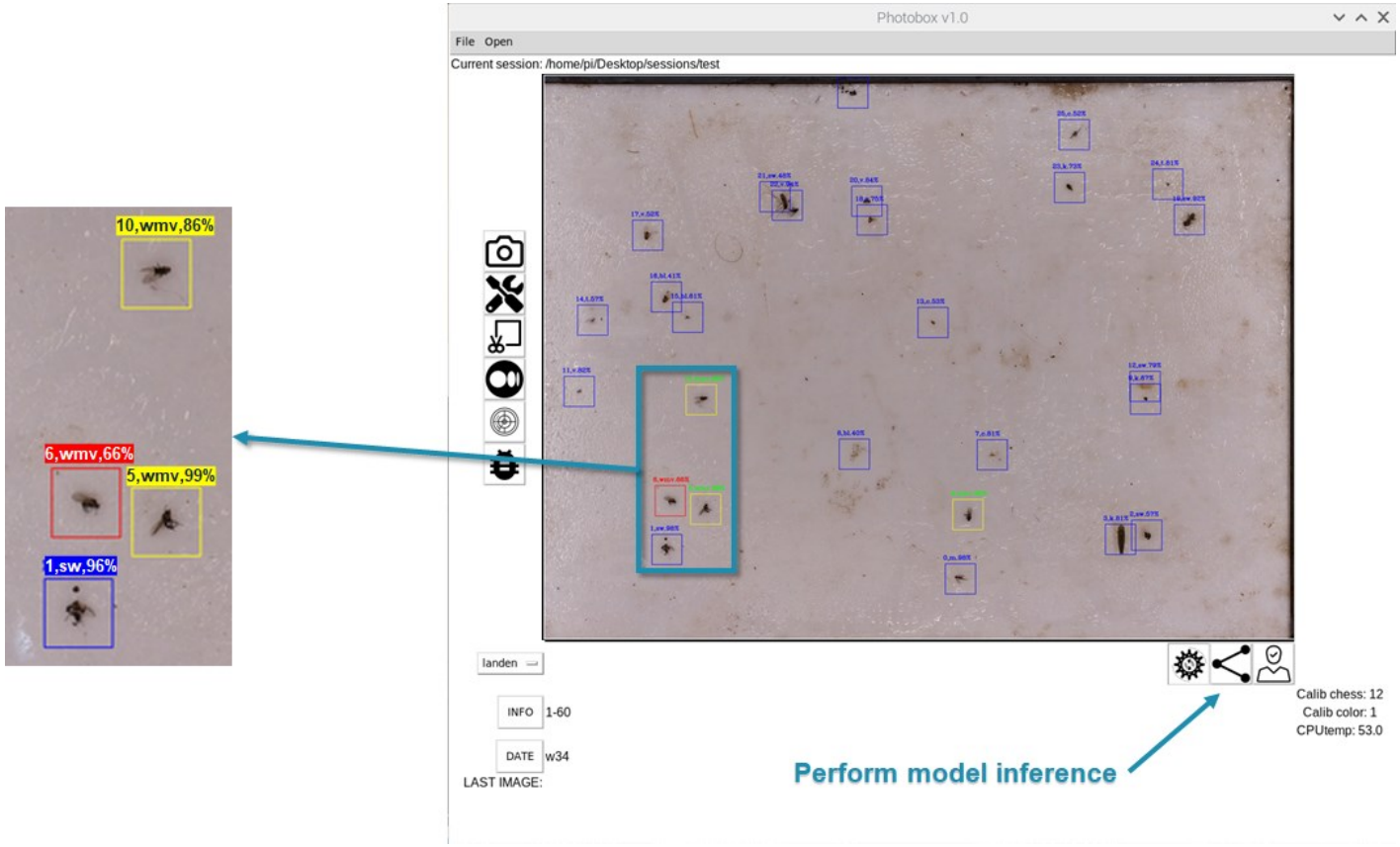
3.4. Take advantage of nature

3.1. Low risk substances

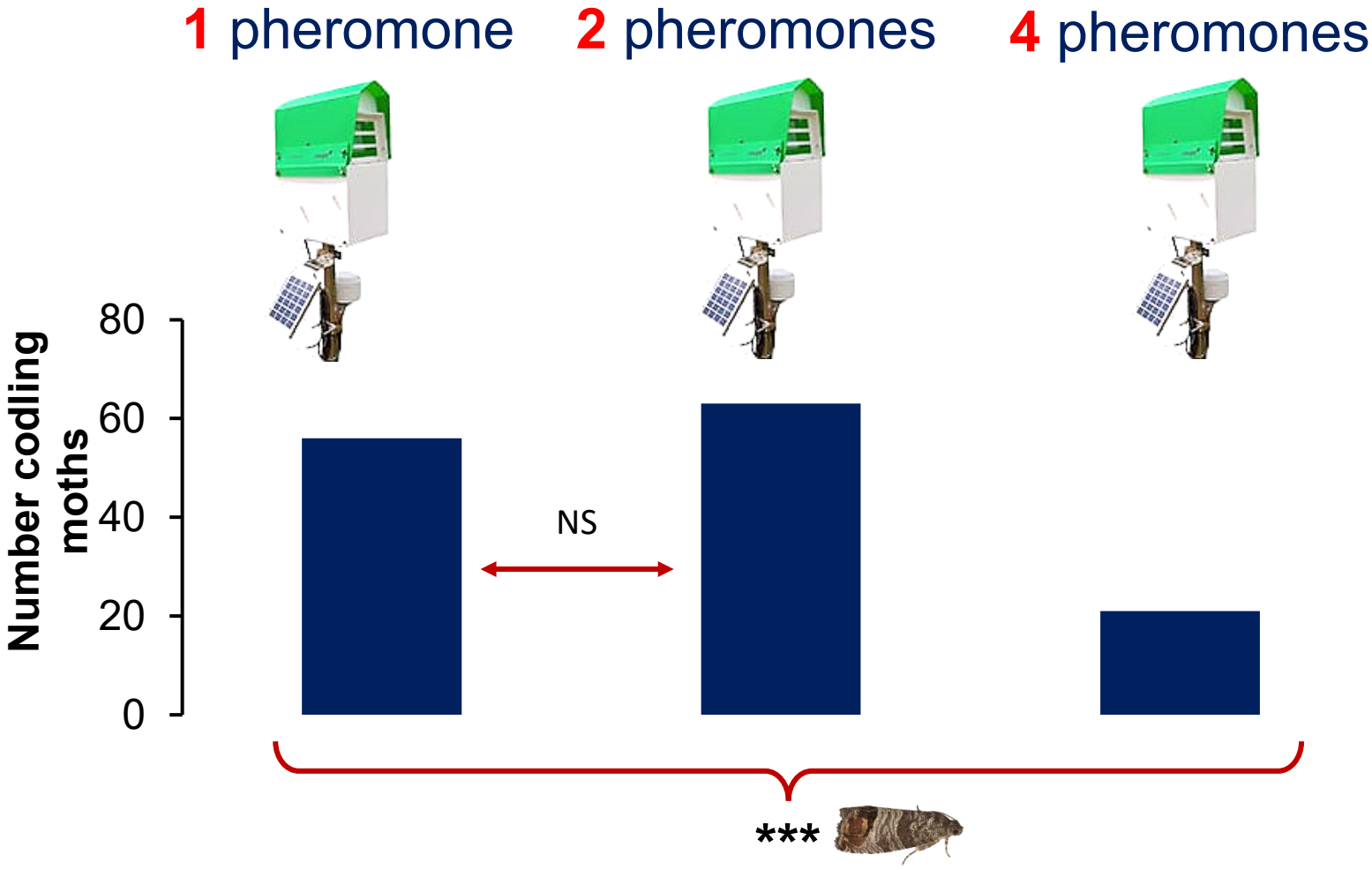
Group	Example	Used in IPM	Used in organic
Semiochemicals	pheromones	+++	+++
Plant Defense Enhancers	phosphonates	++	-
Microbials: viruses	Cp granulosis	+	++
Microbials: bacteria	Bt	+	++
Microbials: fungi	*A. pullulans*	+	++
Microbials: nematodes	*S. kraussei*	(++)	(++)
RNAi	NA	-	-
Antibodies	NA	-	-
Plant extracts	azadirachtin	+	+++

3.2. Better prediction of risks of pests and diseases: Monitoring 2.0

Artificial intelligence in vision learning

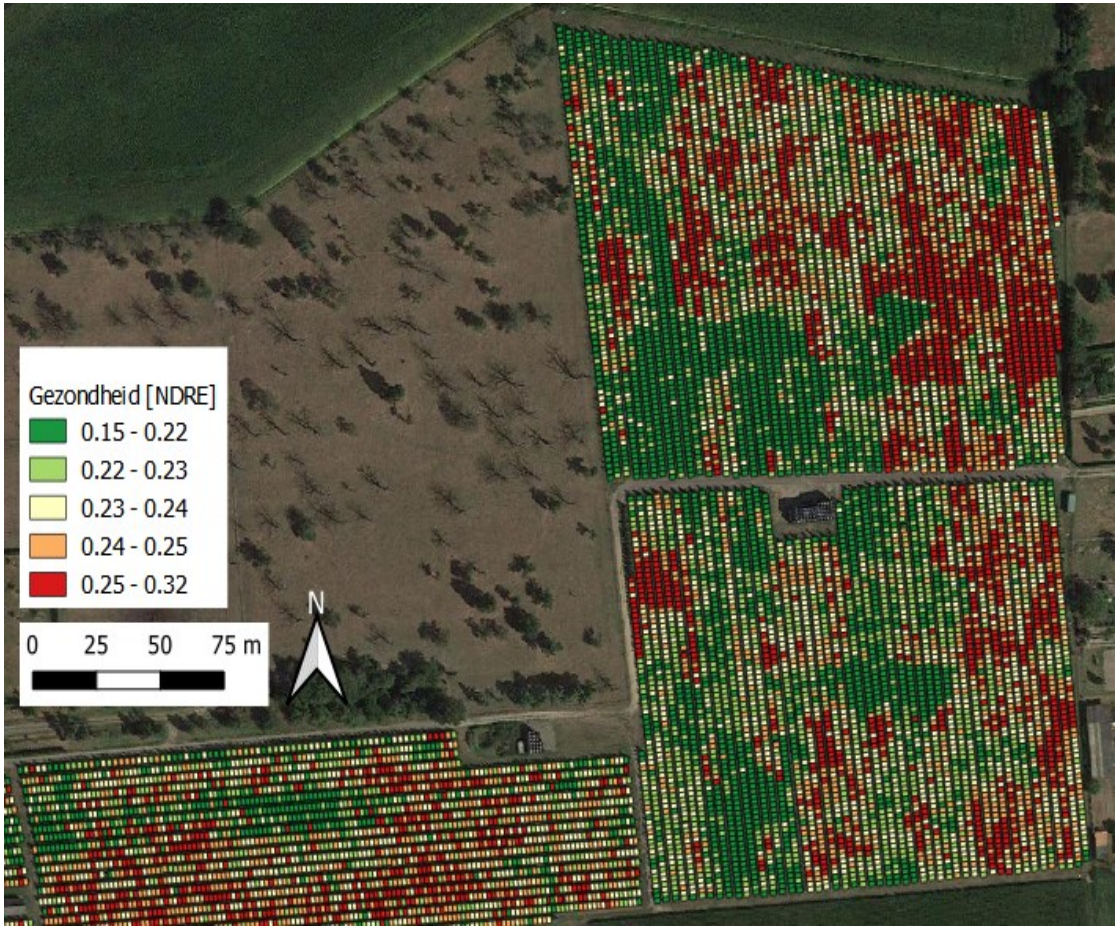


Evalution of multiple pheromones in one trap with camera



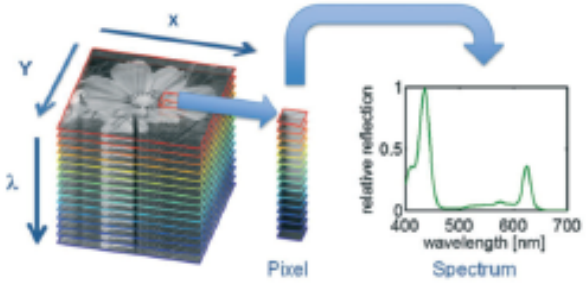
Sensing → data → information →action

Individual tree treatment or dose adaptation per tree is possible:
Potential targets:
weeds, thinning, blossom weevil, … but limited

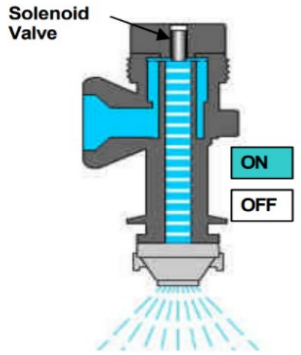


3.3. Precision appliction
Detection (synchrone of asynchrone) triggers deposition

C. Spectral disease detection systems

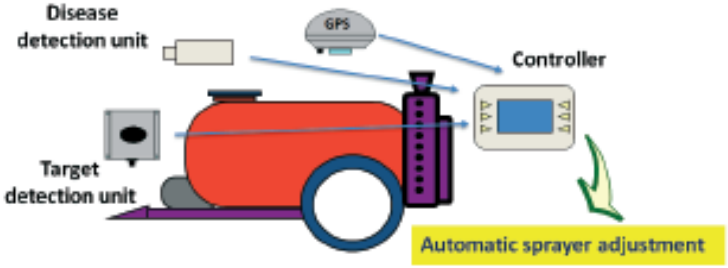


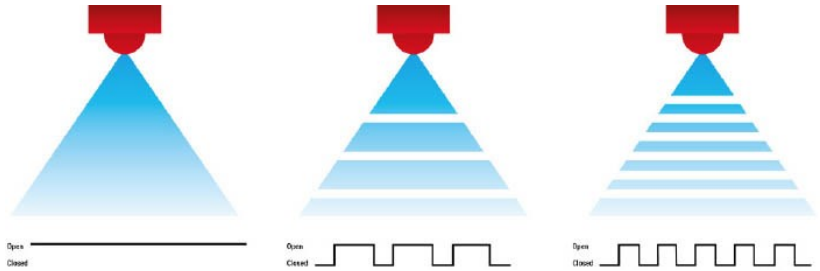
Pulse Width Modulation (PMW)



Cross-section illustration of a PWM solenoid-actuated nozzle body.

D. Precision spraying techniques





3.4. Take advantage of nature

Past (90s)

Typhlodromus pyri

Today

Typhlodromus pyri

Trombidiidae

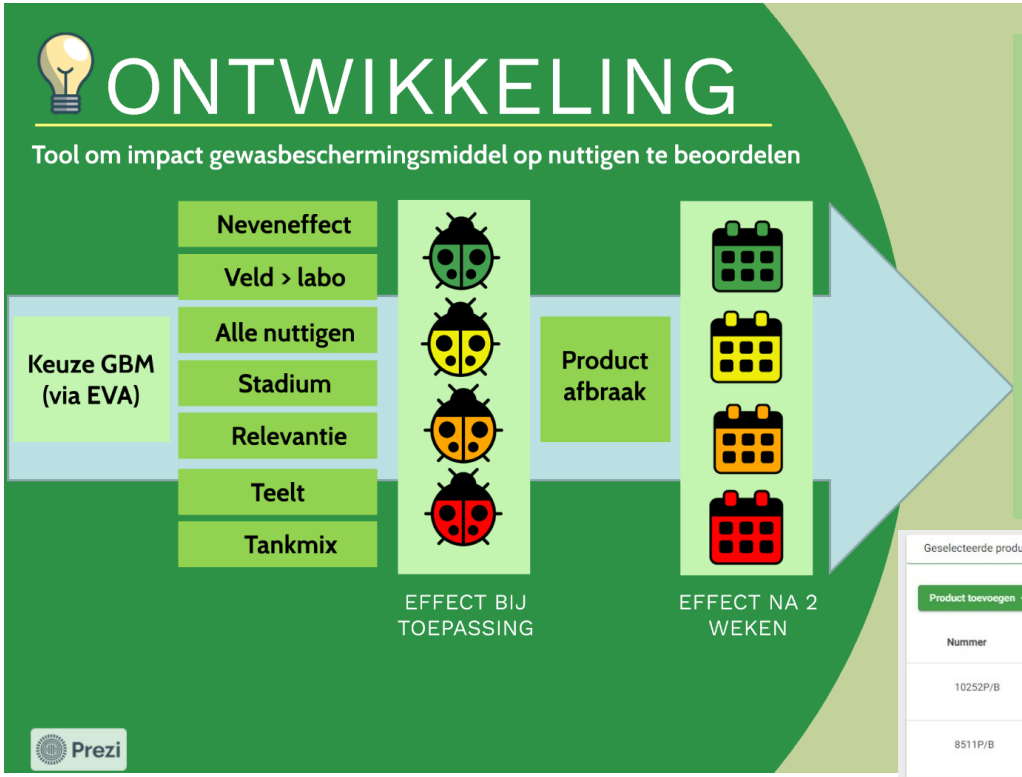
Aphelinus mali

Aranaea

Forficula auricularia

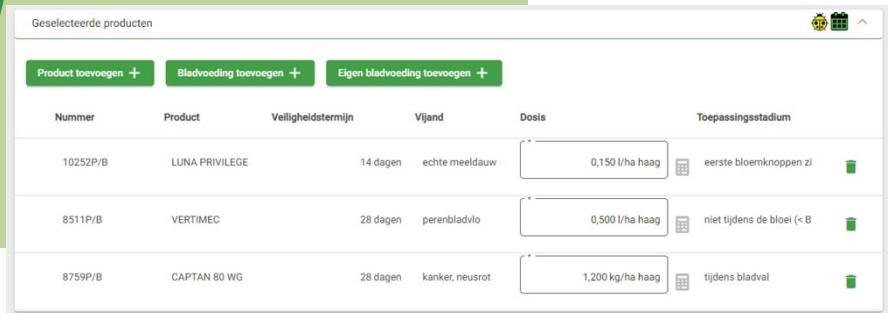
Anthocoridae

The impact indicator



Ongoing:

- more beneficials?
- less treatments?
- more biodiversity?
- Integrated disease mgt via microbioom? (foliar/fruit/soil)
- Less storage rot?



Functional Agrobiodiversity

Advantages:
- Beneficials : alternative food
- Landscape & biodiversity

Constraints:
- Effect limited in distance
- Increase of vole population

Alix, A., Bylemans, D., Dauber, J., Dohmen, P., Knauer, K., Maltby, L., ... & Smith, B. (2022). *Optimising agricultural food production and biodiversity in European landscapes: Report of an online-workshop* (No. 98). Thünen Report.

Farmer's eagerness to apply ?

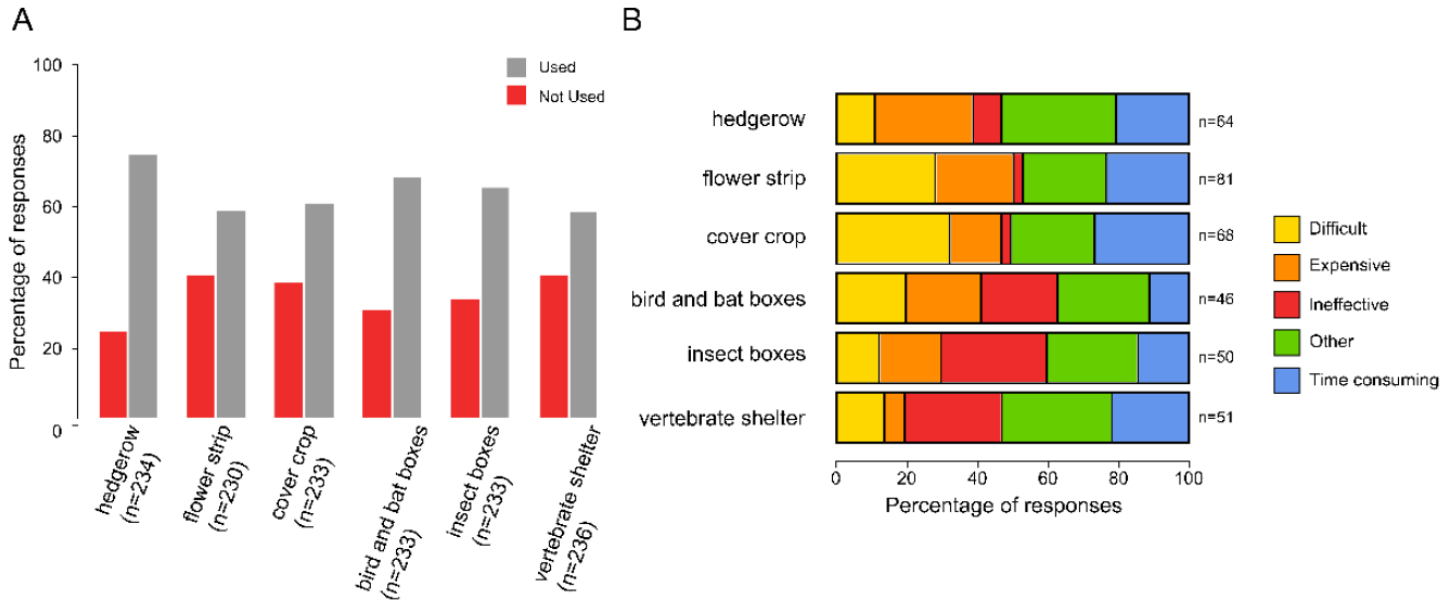


Figure 7. Frequency of adoption of practices aiming at increasing the functional biodiversity of organic fruit orchards in 26 European countries (**A**), the distribution of negative factors affecting the adoption of functional diversity practices in organic orchards (**B**).

Furmanczyk et al. (2022). Agriculture 12: 2136

Concerns

Facts	Consequences
Less PPPs authorized	Suboptimal choice of PPPs More pests and diseases: no advice possible
Extralegal requirements / zero residue	Always the same a.i.'s used Choice for broader spectrum activity Technical reasons for choice product irrelevant
Narrow spectrum FFP	More applications in open systems like orchards ☞ bad perception neighbours and bystanders
Fruit farms become bigger & evolution to 'land owners'	Less interest in diversified strategy on parcel level ☞ solution: Precision agriculture
Income farmer under pressure	Tech investments postponed
Invasive pests and diseases...	... turn back the time on the level of IPM
Good news shows of scientific world	Public opinion questions need for PPPs

Conclusions & recommendations

- Do not aim to reduce PPP use by reducing the number of a.i's nor by the reduction of PPP volumes. Judge the impact.

- Invest in innovation : more accurate warning systems (incl. weather predictions, personalized warnings, …) & smart farming technology

- Invest in communication: risks for consumers, financial risk for growers, …

Thanks for your attention

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