Use of IPM in horticultural crops – challenges and opportunities

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BCPC Pests and Beneficials Annual Review

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DIRECTIVE 2009/128/EC OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL
establishing a framework for Community action to achieve the sustainable use of pesticides

Member States should promote low pesticide-input pest management, in particular,

'**Integrated Pest Management**'

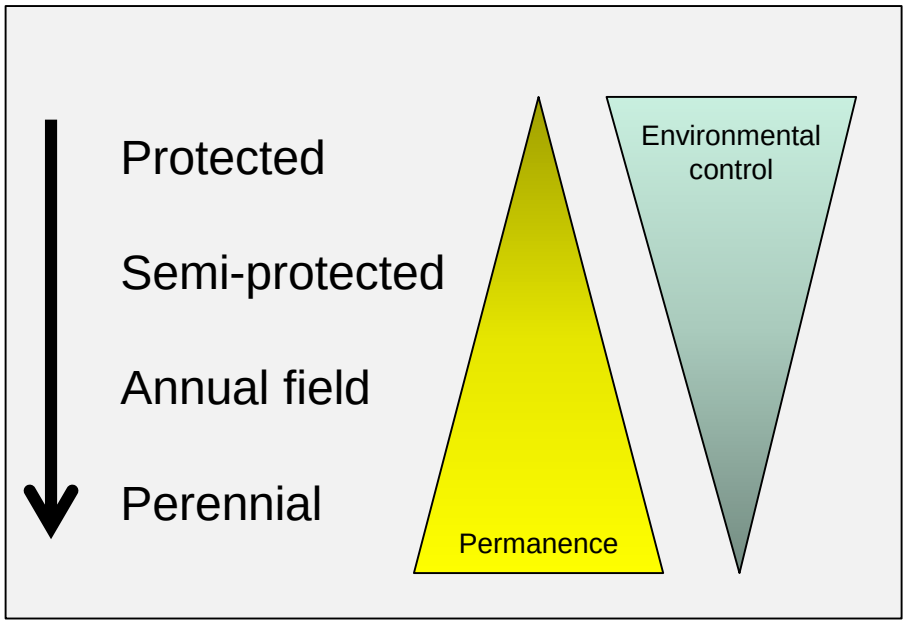
and establish the necessary conditions and measures for its implementation.

Horticultural crops

- Essential for our health and well-being!
- Small physical footprint
- Significant economic value
- Extremely diverse – species and growing systems
- Quality is paramount

Diversity of species!

Diversity of cropping systems



Quality is paramount

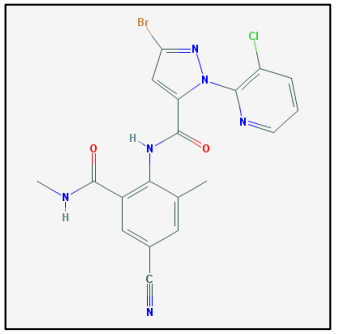
- Quality determines marketable yield
- Uniformity is very important – size/shape, appearance and maturity date
- Contaminants are unacceptable – even if they are beneficial insects!
- Marketed part of plant can sometimes be protected without direct application of pesticides

Pesticides

- Armoury restricted – particularly when considered by crop
- Small market - so limited commercial incentive to develop new products
- SOLAs & EAMUs have saved the day…
- SCEPTRE and now SCEPTRE+

Insecticides

- Were OPs, carbamates, pyrethroids……
- Now pyrethroids, neonicotinoids, diamides, spinosyns, tetronic and tetramic acid derivatives, oxadiazines, benzoylureas, pyridine azomethine derivatives, flonicamid, sulfoximines…
- But we need to look after our molecules
  - we may not get many more!



Insecticide resistance has implications for horticulture

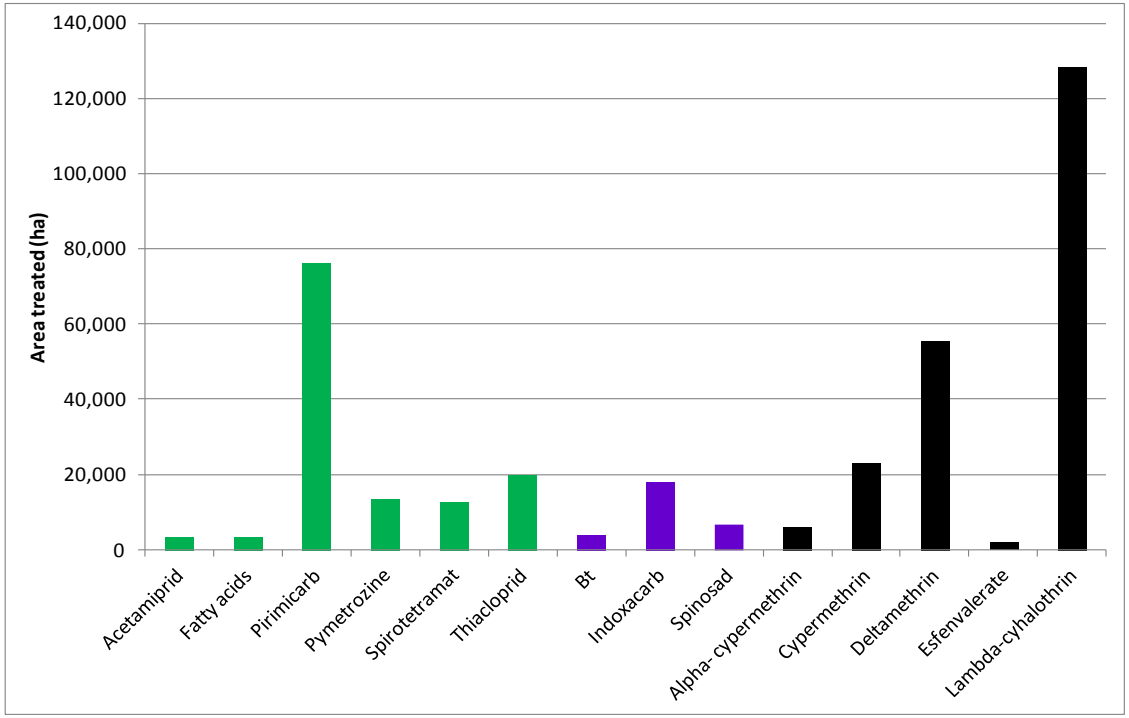
Species	1A Carbamates	1B Organophosphates	2A/3B OCs	3A Pyrethroid	4A Neonicotinoids	15 Bezoylureas (IGRs)	21A METI	28 Diamides
Aphis gossypii	1	1		1	1			
Aphis nasturtii	1	1						
Bemisia tabaci						1		
Macrosiphum euphorbiae								
Myzus persicae	1	1		1	1			
Nasonovia ribisnigri	1			1				
Phorodon humuli	1	1	1					
Psylla pyricola								
Trialeurodes vaporariorum	1	1	1	1	1	1		
Aleyrodes proletella				1				
Adoxophyes orana								
Plutella xylostella				1				1
Tuta absoluta		1		1		1		1
Delia antiqua			1					
Delia radicum			1					
Delia platura			1					
Liriomyza huidobrensis								
Phoridae		1						
Pslia rosae			1					
Drosophila suzukii								
Scaptomyza flava				1				
Sciaridae								
Meligethes (aeneus)				1				
Frankliniella occidentalis		1		1				
Thrips tabaci				1				
Acarus siro		1	1					
Panonychus ulmi								
Tetranychus urticae		1	1	1			1	

Established

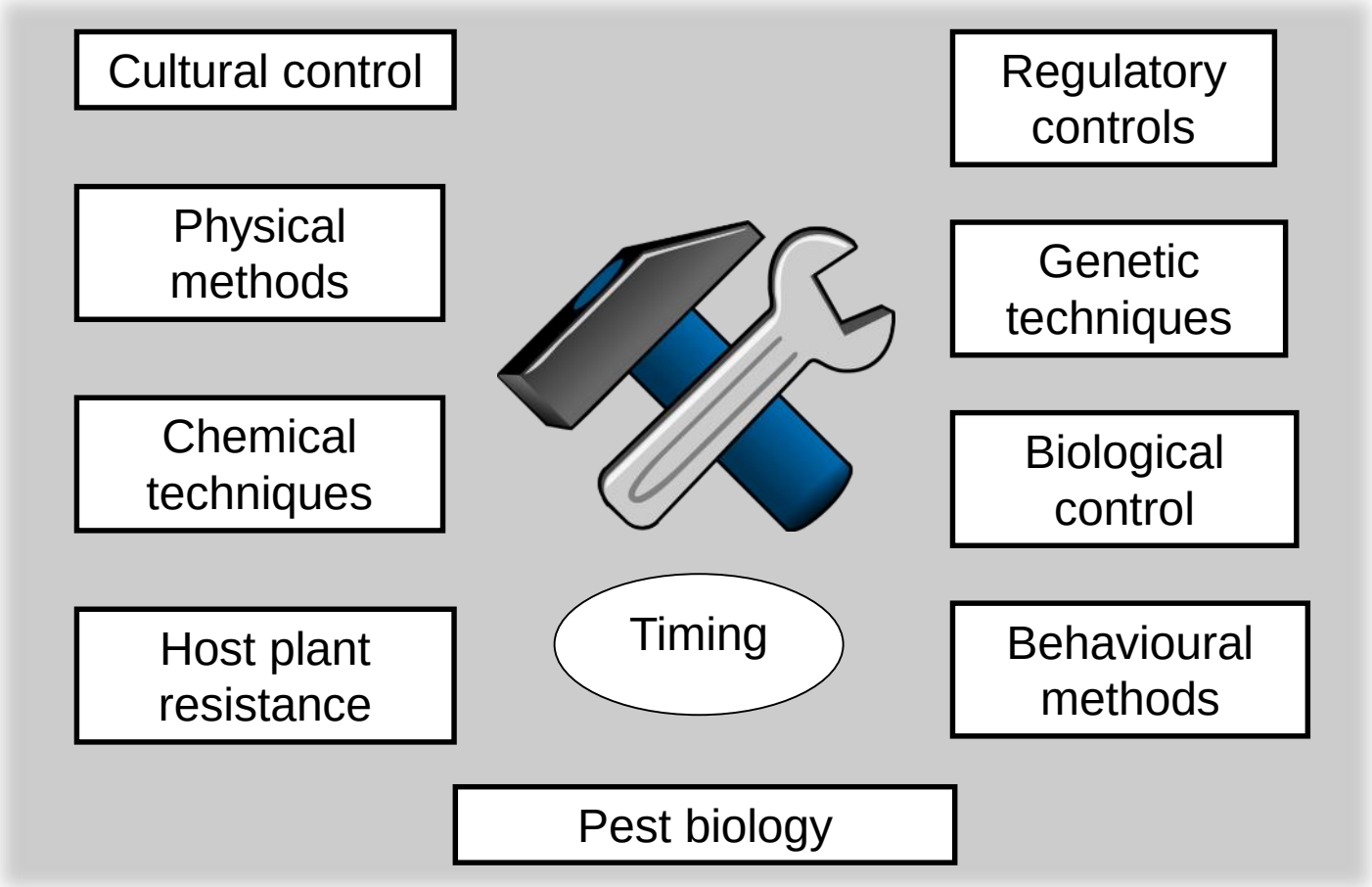
Suspected

Source: IRAG

All outdoor vegetables - areas treated with different insecticides – aphicides in green, pyrethroid insecticides in black and other caterpillar control in purple



Pesticide Usage Survey Report 257 - Outdoor Vegetable Crops United Kingdom 2013


Cultural control
Regulatory controls
Physical methods
Genetic techniques
Chemical techniques
Biological control
Timing
Host plant resistance
Behavioural methods
Pest biology

IPM tools!

Cultural control

- Rotation
- Spatial separation
- Managing alternative hosts
- Crop hygiene
- Cover crops
- Increased diversity – spatially and temporally

- Value underrated?
- Specialisation can limit scope to implement

Biocontrol – tomato production

- Protected
- High value
- System developed to accommodate pollinators and avoid insecticide resistance
- **Inundative/inoculative biocontrol**
- Well-developed system – need to adapt when new problem arrives e.g. *Tuta absoluta*

Transferable to open fields?

Inundative/inoculative biological control

	GLASSHOUSE	OPEN FIELD
Released predators	Captive	Free
Boundary effects	Bounce back	None
Hungry predators	Search better	Leave faster
Environment	Controllable	Highly variable
Alternative food	None	Many sources

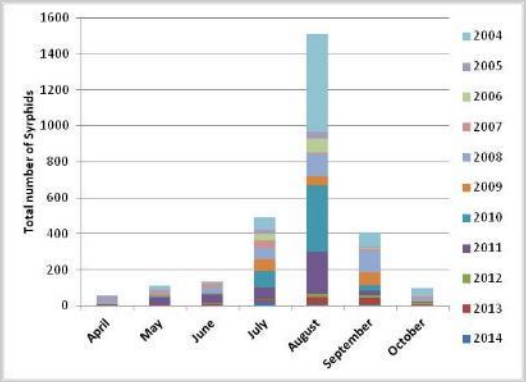
Similarities between systems = NONE!!

Conservation biocontrol - orchards

- Predatory mites that are resistant to insecticides
- Earwigs

Conservation biocontrol with sweet alyssum

Photo credit: Eric Brennan, USDA-ARS

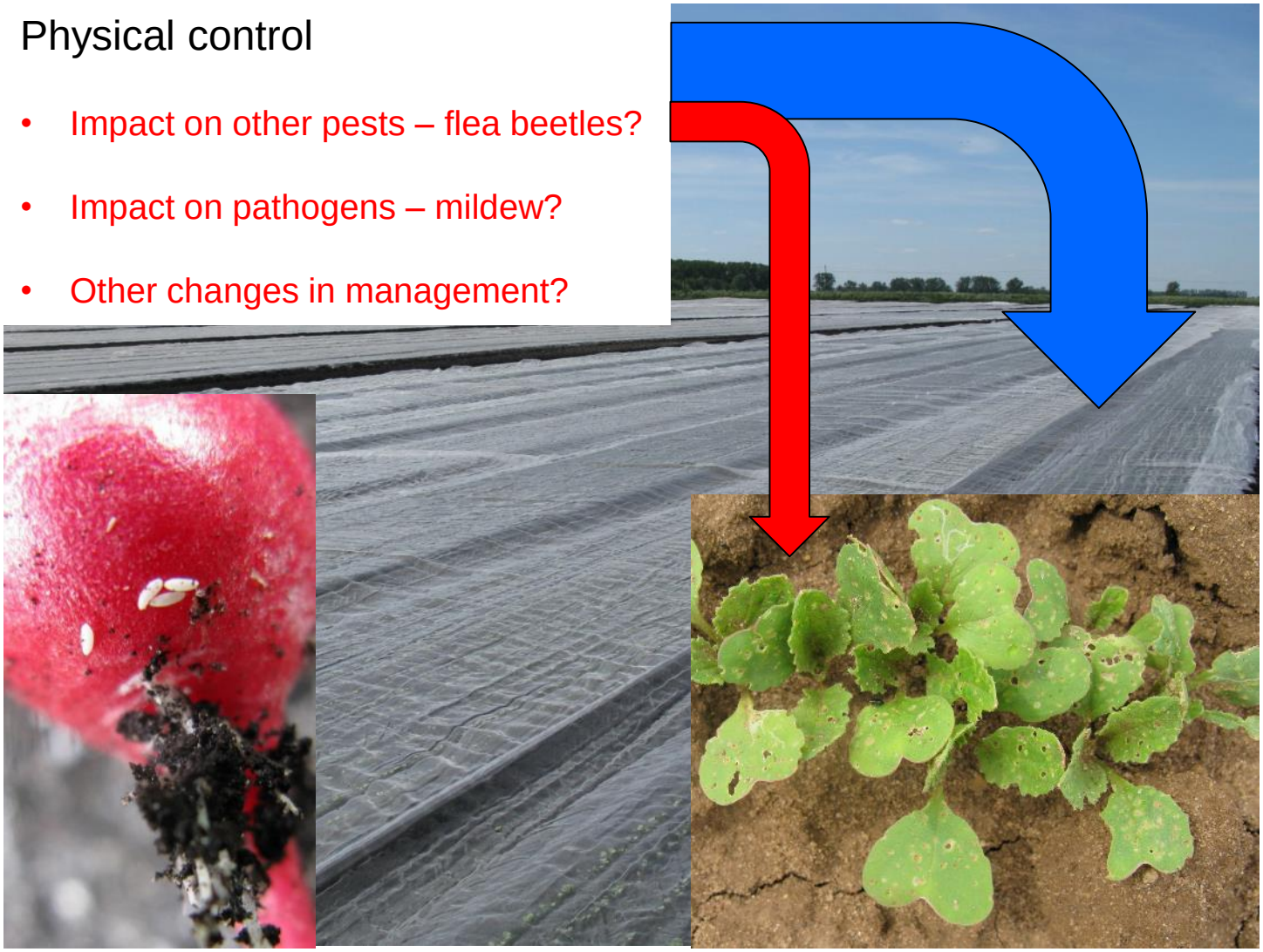


Syrphid numbers in water traps
Warwick Crop Centre UK

Transferable to other climates?

Physical control

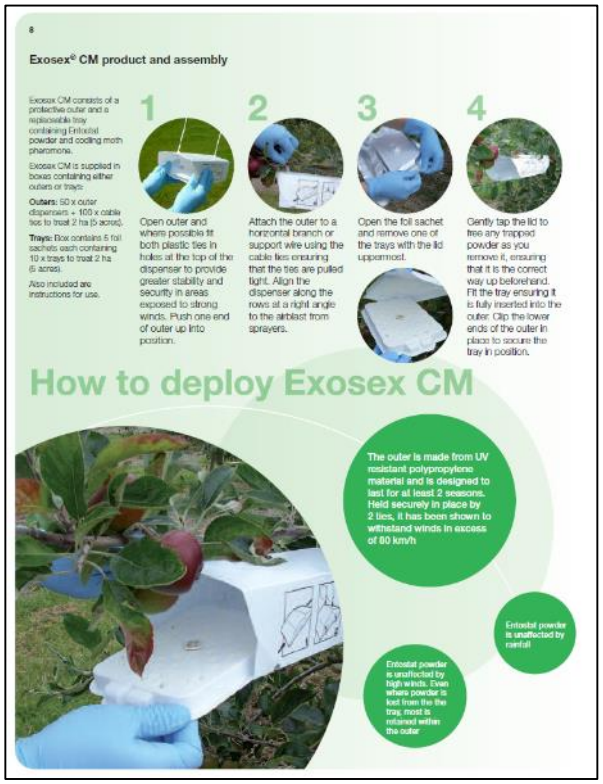
- Impact on other pests – flea beetles?
- Impact on pathogens – mildew?
- Other changes in management?

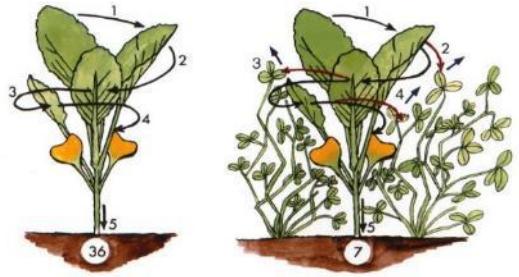


Host plant resistance

- Some good examples – but few in number (small market?)
- Relatively long timescale
- Need to protect the mechanism – *Nasonovia* resistance lasted 10 years!
- Relatively little effort is being made to breed for pest resistance?
- Little funding available for phenotyping considerable amount of genetic variation available in gene banks and other collections of plant genetic diversity

Behavioural methods





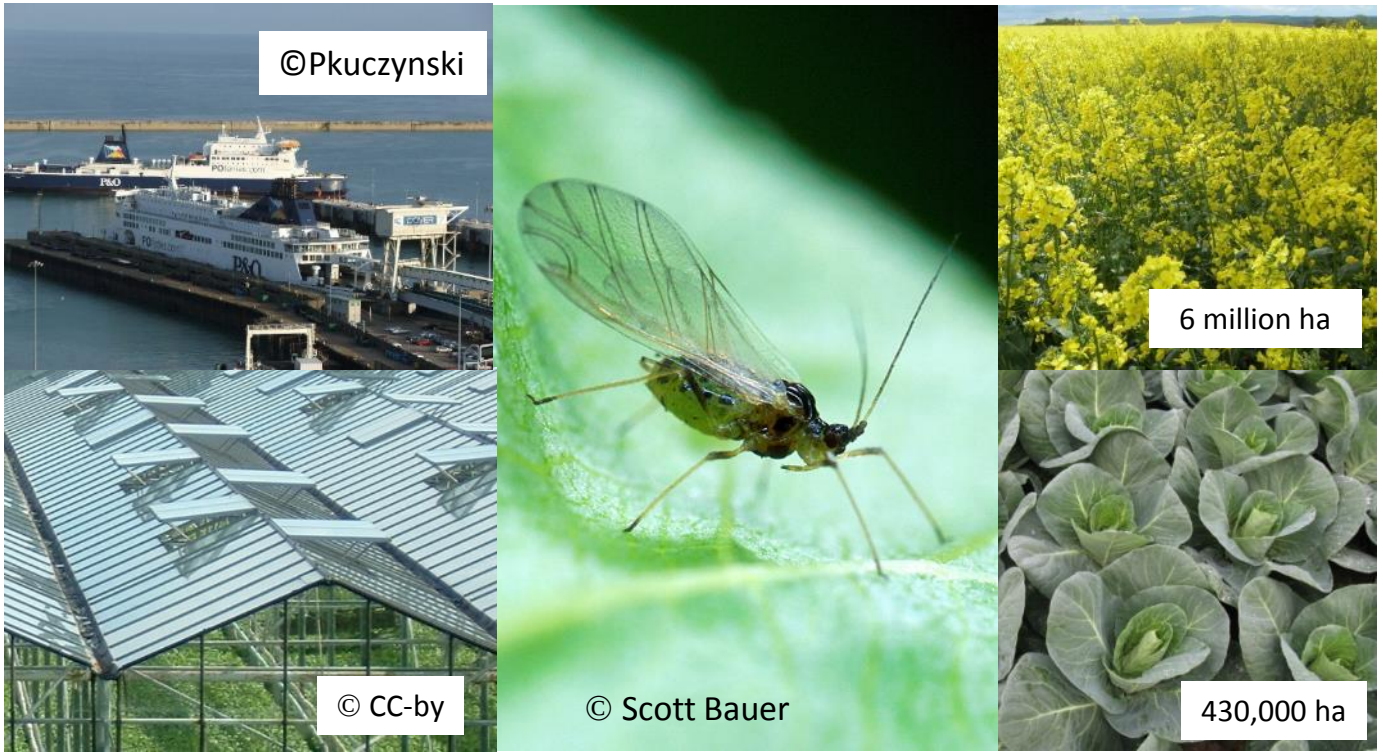
Decision support

- Monitoring
  - Traps
  - Other approaches
  - Crop
- Forecasting
- Role of networks?

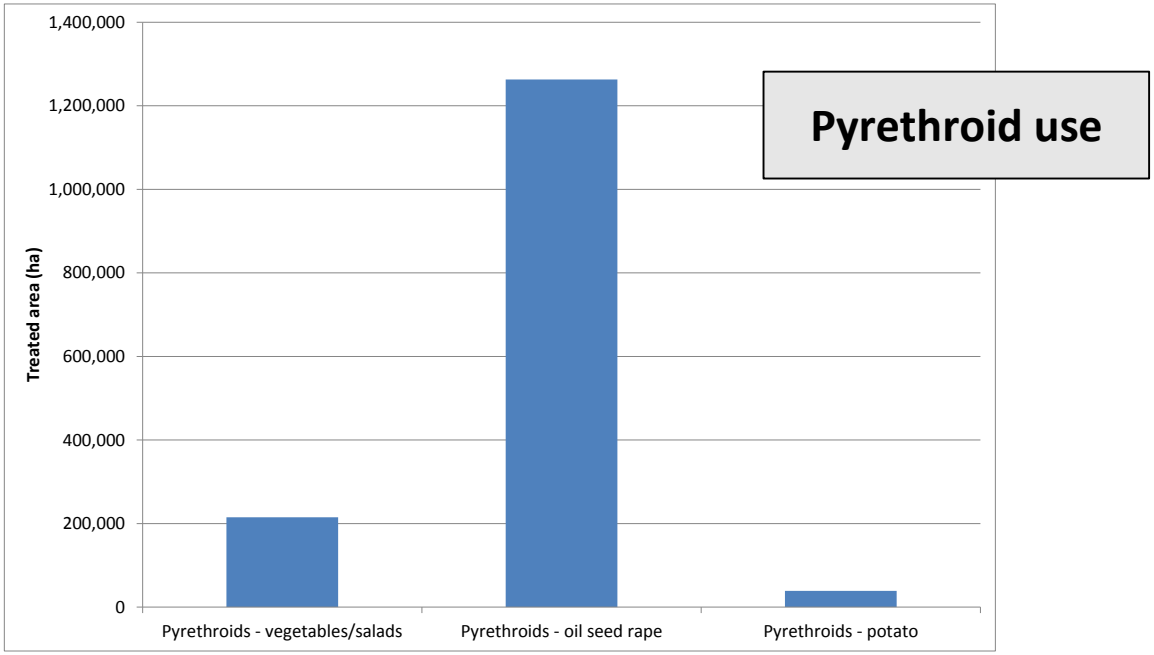
Thresholds!

- Do they have a role in horticulture?
- Growers risk-averse due to high quality requirements
- Varieties and growing systems very diverse

Mobility of pests?



And where is the selection pressure applied?



Pest management at a landscape scale?

- Which crops and wild hosts are reservoirs for pests and diseases?
- Green bridges?
- Functional biodiversity is not easy to implement and manage
  - efficacy is not proven and not predictable.
  - needs to be coordinated at a landscape scale.

How well are we doing?

- Great progress in protected crops - outdoor crops further behind
- Ehler (2006) talked about integrated *pesticide* management (the other IPM) - the *discriminate* use of pesticides…
- Suggested that although laudable, this perpetuates a ‘quick-fix mentality’ that targets symptoms and fails to address the root causes of pest problems

Pest Management Science 6: 787-789

Achieving IPM?

- Have we sufficient effective tools to achieve the levels of pest control we need? If not, how do we acquire them?
- Whole crop IPM?
- Are there ‘big’ wins in simply improving use of appropriate control measure at appropriate time in appropriate place – and at a landscape scale?
- How do we encourage uptake and optimal use of IPM tools? E.g. AMBER project!
- What is the role of the state versus industry?
- Collaboration is likely to be key when resources are limited! Importance of Europe?

Thank you to

- Organisers of this meeting
- Agriculture and Horticulture Development Board
- G's
- Innovate UK
- My colleagues at the University of Warwick
- Colleagues on EIP Focus Group – 'IPM for *Brassica*'