

# Crop improvement for IPM

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VeGIN Stakeholder Event, 1<sup>st</sup> December 2021



Department  
for Environment  
Food & Rural Affairs



WARWICK  
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or

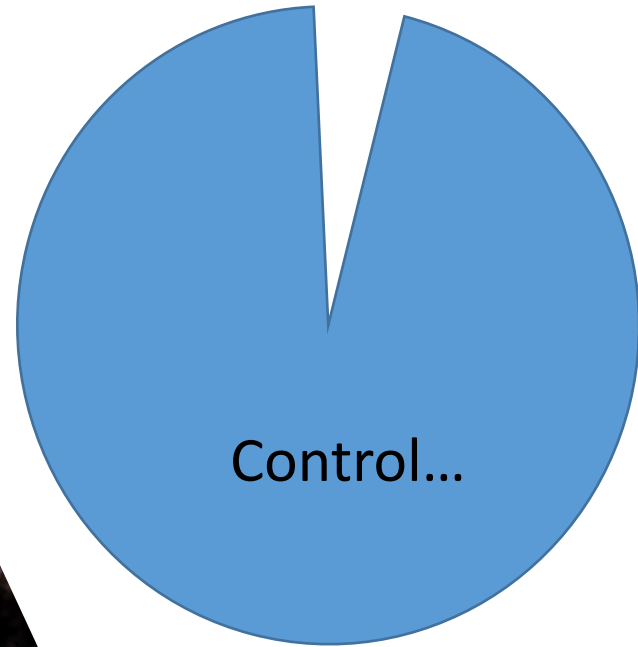


Complete host  
plant  
resistance

or



1950-2000?



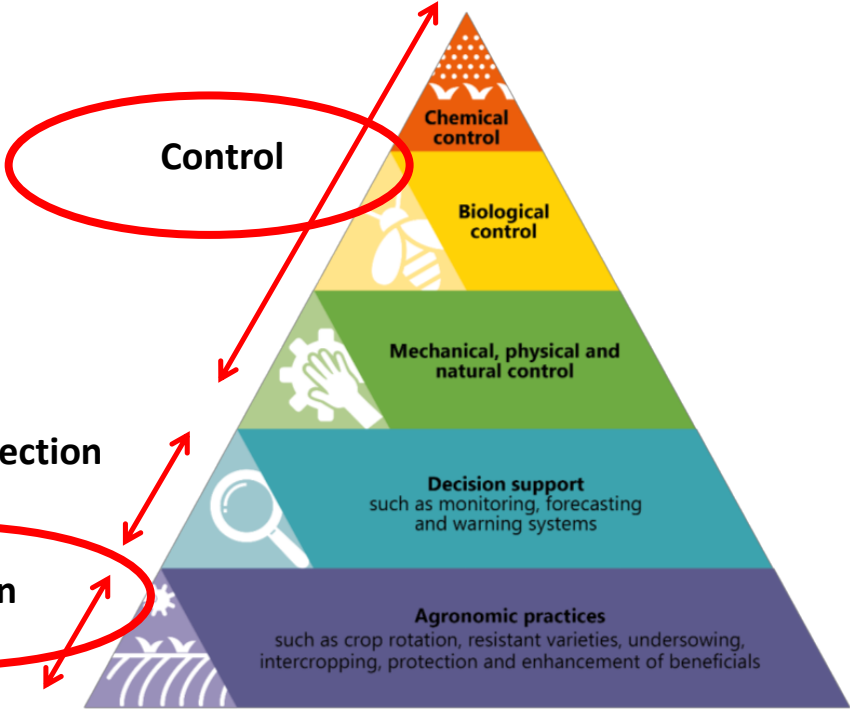
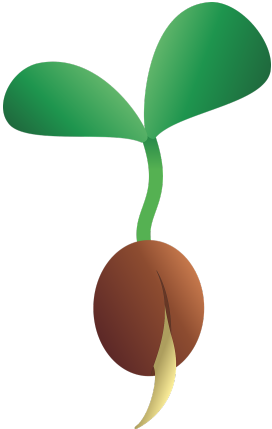
For each 'pest'  
expect >90%  
control from just  
one of these

*Increasing number of well-known issues with these very effective tools, especially pesticides, but including 'complete' host plant resistance:*

- Complete host plant resistance usually due to a single gene
- In what may be an extreme case, 50 dominant (*R*) genes for resistance to downy mildew (*Bremia lactucae*) have been used in lettuce cultivars
- Provide high levels of resistance, but are continually overcome by 'new' strains of *Bremia*
- 'Arms race' between plant and pathogen
- Similar situation with resistance to *Nasonovia ribisnigri*



# 2020 and beyond?



Detection

Control

Prevention

Chemical control

Biological control

Mechanical, physical and natural control

Decision support  
such as monitoring, forecasting and warning systems

Agronomic practices  
such as crop rotation, resistant varieties, undersowing, intercropping, protection and enhancement of beneficials

## IPM – Integrated Pest (disease & weed) Management

*'... a decision-based process involving coordinated use of multiple tactics for optimizing the control of all classes of pests (insects, pathogens, weeds, vertebrates) in an ecologically and economically sound manner.'*

Prokopy, R.J. (2003). Agric. Ecosyst. Environ 94, 299-309.



**What further roles might plant breeding play in IPM?**

## Opportunities for partial host plant resistance?

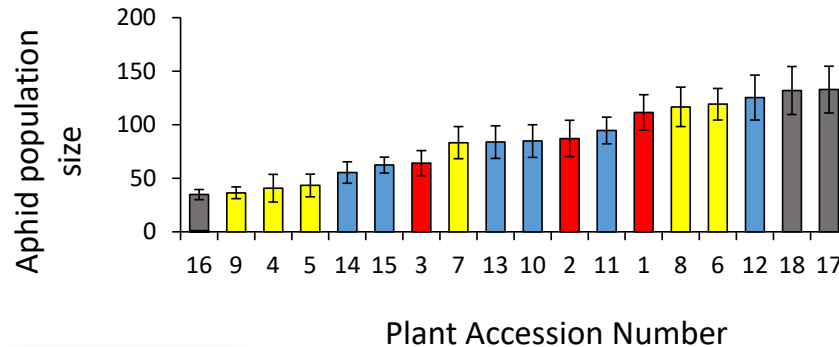
- Typically due to a number of genes
- May be several resistance mechanisms working together
- Less selection pressure for 'resistance breaking'
- Can be used within an IPM strategy to achieve desired levels of control
- Has been low priority for breeding?

Partial host plant resistance might be combined with:

- **Pesticides** – e.g. fewer applications/lower doses/lower efficacy
- **Biopesticides** – e.g. slower pest development may give them more of a chance
- **Natural enemies** – e.g. plant structure may be important for competitive advantage
- Other approaches that influence the pest, pathogen or a natural enemy e.g. semiochemicals

# Project: Biological crop protection: a new 'slow down/speed up' strategy for aphid management

- Partially resistant *Brassica* lines (VeGIN)
- *Myzus persicae*, *Brevicoryne brassicae*
- Fungal pathogens
- Parasitic wasps
- Cis-jasmone – application leads to plant volatile production which can attract parasitic wasps. Plants vary in response.



BBSRC/NERC Sustainable Agriculture Research and Innovation Club (SARIC):  
Warwick, Keele, Harper Adams, Durham, ADAS and associated PhD at Warwick  
Led by Dave Chandler

# Role for plant breeding in 'polyculture'

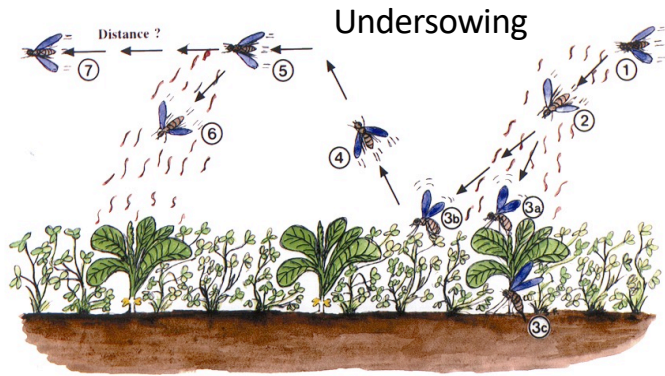
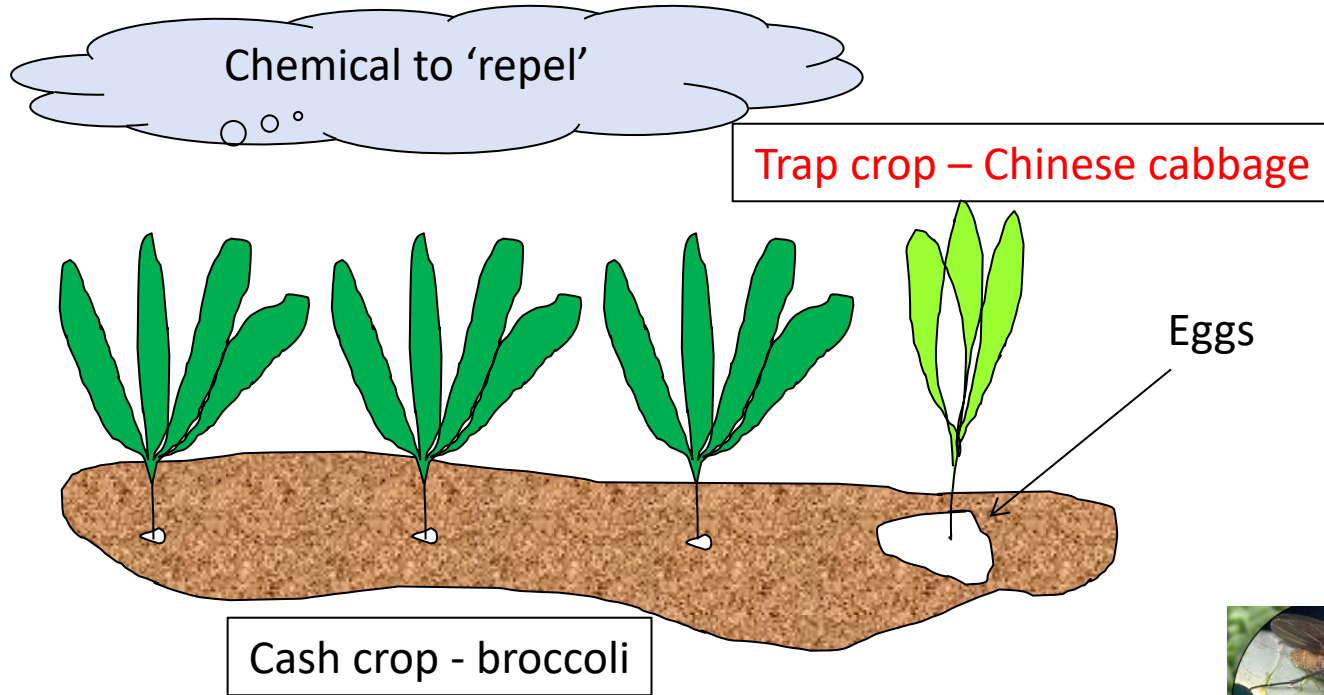


Photo credit: Eric Brennan, USDA-ARS





# Other opportunities for plant breeding



Cabbage root fly - Cortesero et al., University of Rennes, France



## Final thought – plant genetics must influence a number of other processes and interactions

- **Induced resistance** to pests and pathogens
- Response to **biostimulants** of various types
- **Interactions with microorganisms** – around roots and foliage e.g. in VeGIN response of onion lines to Arbuscular Mycorrhizal Fungi (AMF)
- **Interactions with endophytes** - the microorganisms which mutually live inside healthy plant tissues, playing roles in promoting plant growth and providing adaptation toward various environments
- Plenty of research opportunities to identify what might be useful in commercial cultivars to underpin an IPM strategy!

Thank you:

- My colleagues in School of Life Sciences
- Anne-Marie Cortesero, Eric Brennan
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