

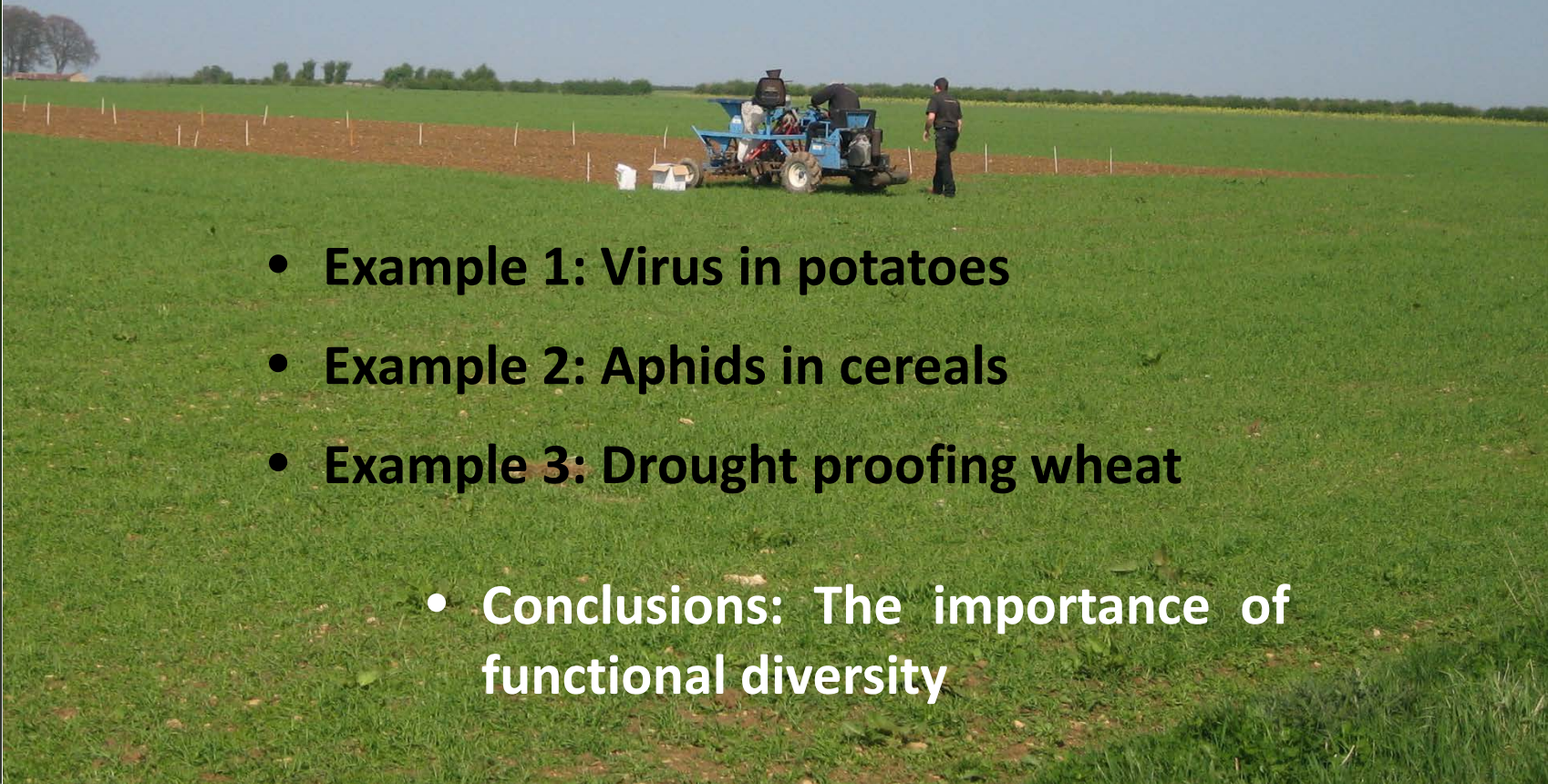
Alternative approaches and lessons from ORC research

Thomas F. Döring



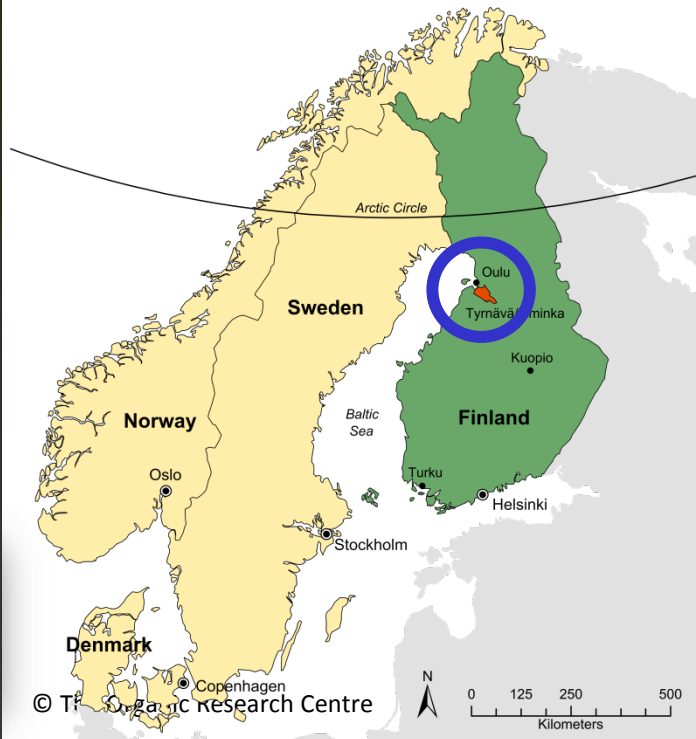
Outline

- Alternatives **to** plant breeding vs. alternatives **within** plant breeding
 - What alternatives are there and what can they deliver?
 - Example 1: Virus in potatoes
 - Example 2: Aphids in cereals
 - Example 3: Drought proofing wheat
 - Conclusions: The importance of functional diversity

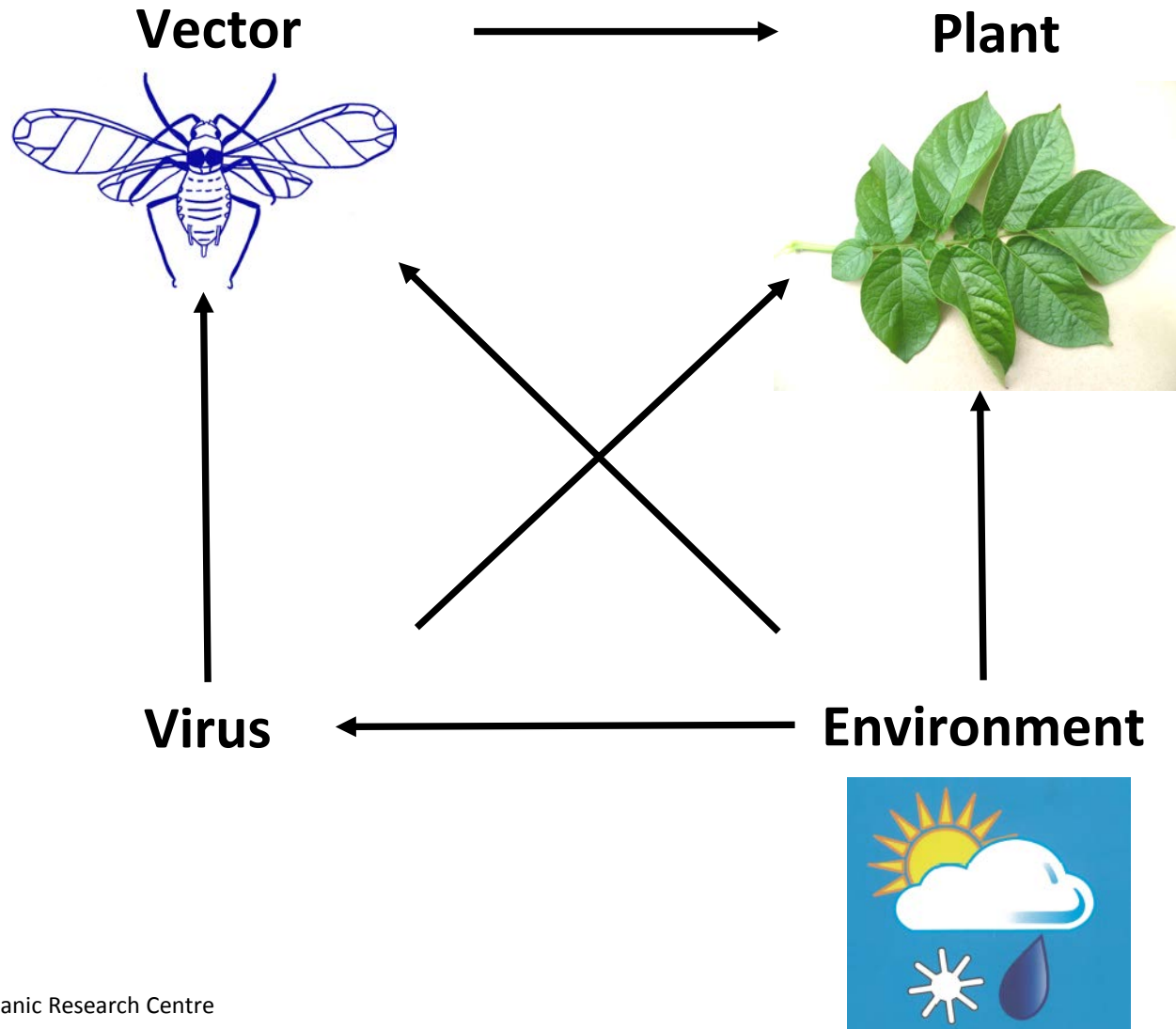


Example 1: Control of Potato virus Y

- **Study area:** Northern Finland; seed potatoes on ~1000 ha, 14000 t/year, 'High Grade Area'
- **Start of PVY-'crisis': 2005:** decertification of seed lots because of high **PVY**



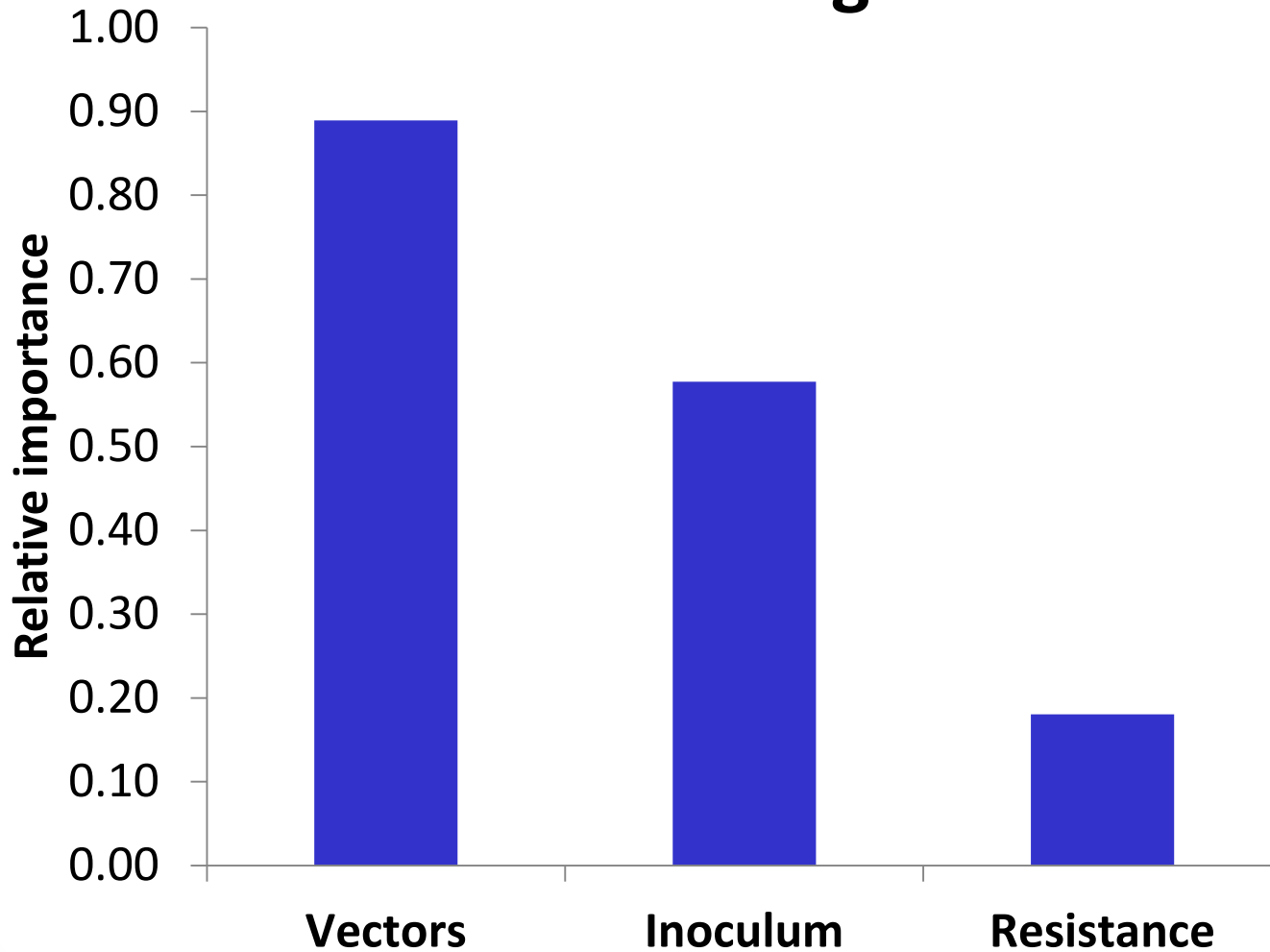
Biology of Potato Virus Y (PVY)



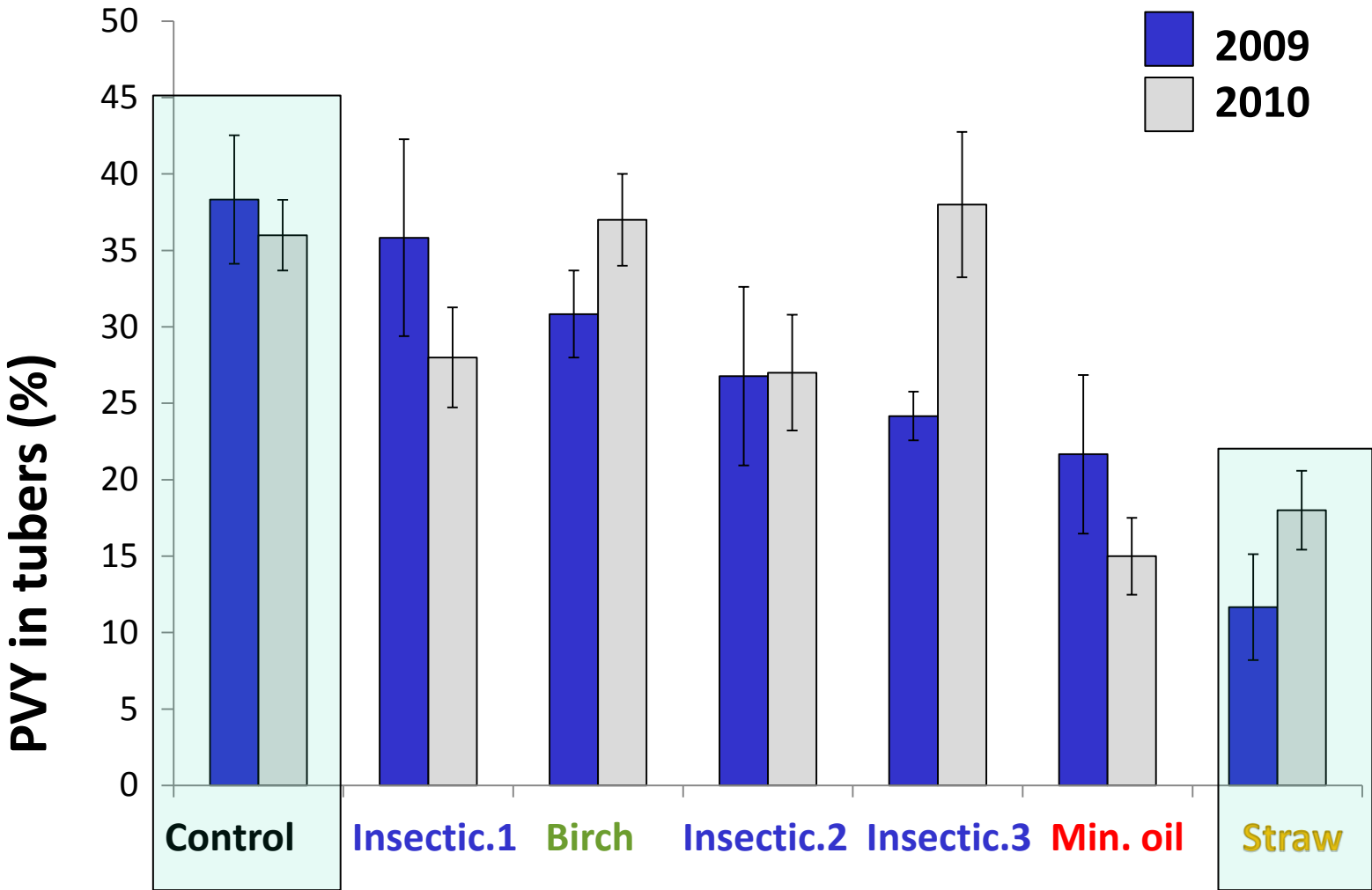
Diverse approaches to control potato viruses

- **Virus resistance (conv.)**
- **Use of certified seed**
- **Vector regulation**
 - Mineral oils
 - Repellents
 - Deterrents
 - Border crops
 - Vector antagonists
 - Mulching
 - Physical barriers
 - Elimination of vector host plants
 - Field design
- **Cropping practices**
 - Plant nutrition (moderate N)
 - Haulm destruction
 - Quick establishment
 - Mature plant resistance
 - Temporal isolation
 - Roguing
 - Weeding and removal of volunteers
- **Other strategies**
 - Regional isolation
 - Isolation within the farm
 - Avoiding mechanical transmission
 - Premunisation

Relative importance of epidemiological factors determining virus incidence



Effect of straw mulch on PVY

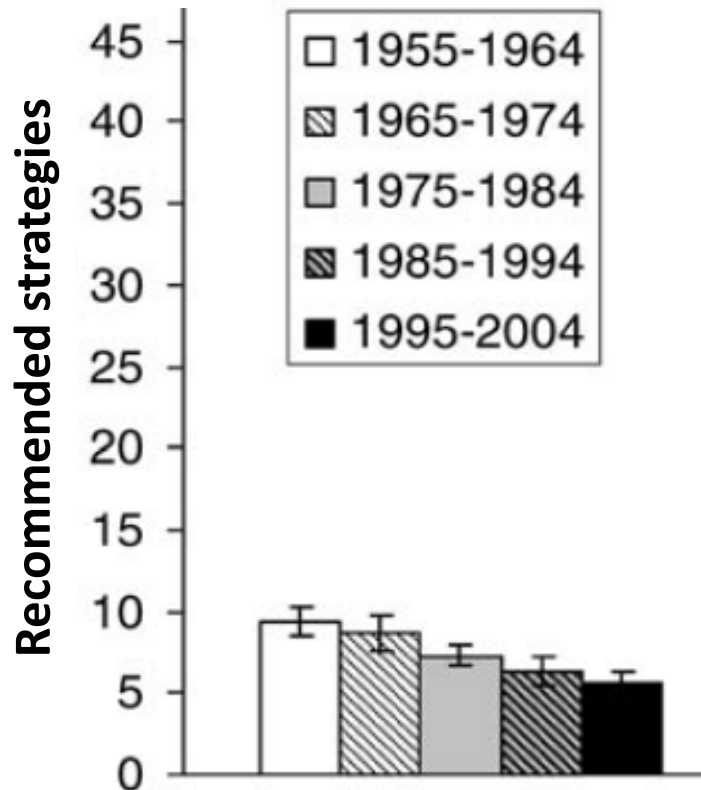


Effect of straw mulch on soil erosion



Döring *et al.* 2005.
Field Crops Res.

Are all alternatives well disseminated?



Diversity of recommended virus control strategies has consistently been decreasing over the last five decades.

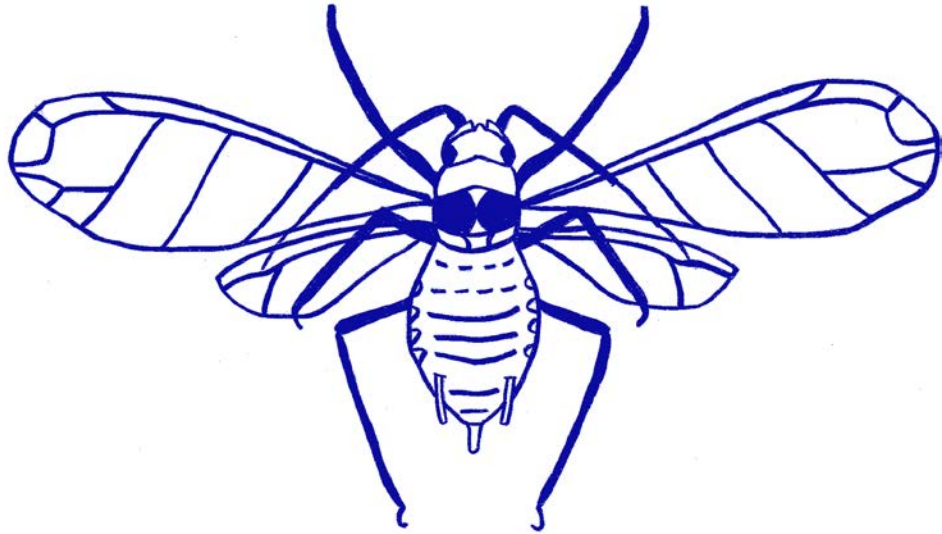
Döring et al. 2006, Potato Research 49:225-239

Example 1: Conclusions

- Do we need plant breeding for virus control? **Yes.**
- Is virus resistance (through plant breeding) the key factor for virus control? **No.**
- Are there alternatives besides plant breeding? **Yes, plenty.**
- Do these alternative approaches deliver? **Yes, many do; some have additional benefits too.**
- What is needed? **Better dissemination, demonstration, cooperation.**

Example 2: Aphids in cereals

- Aim: Low aphid infestation in cereals
- Aim: No negative effects of aphids on longer-term yield performance, yield stability, or crop quality

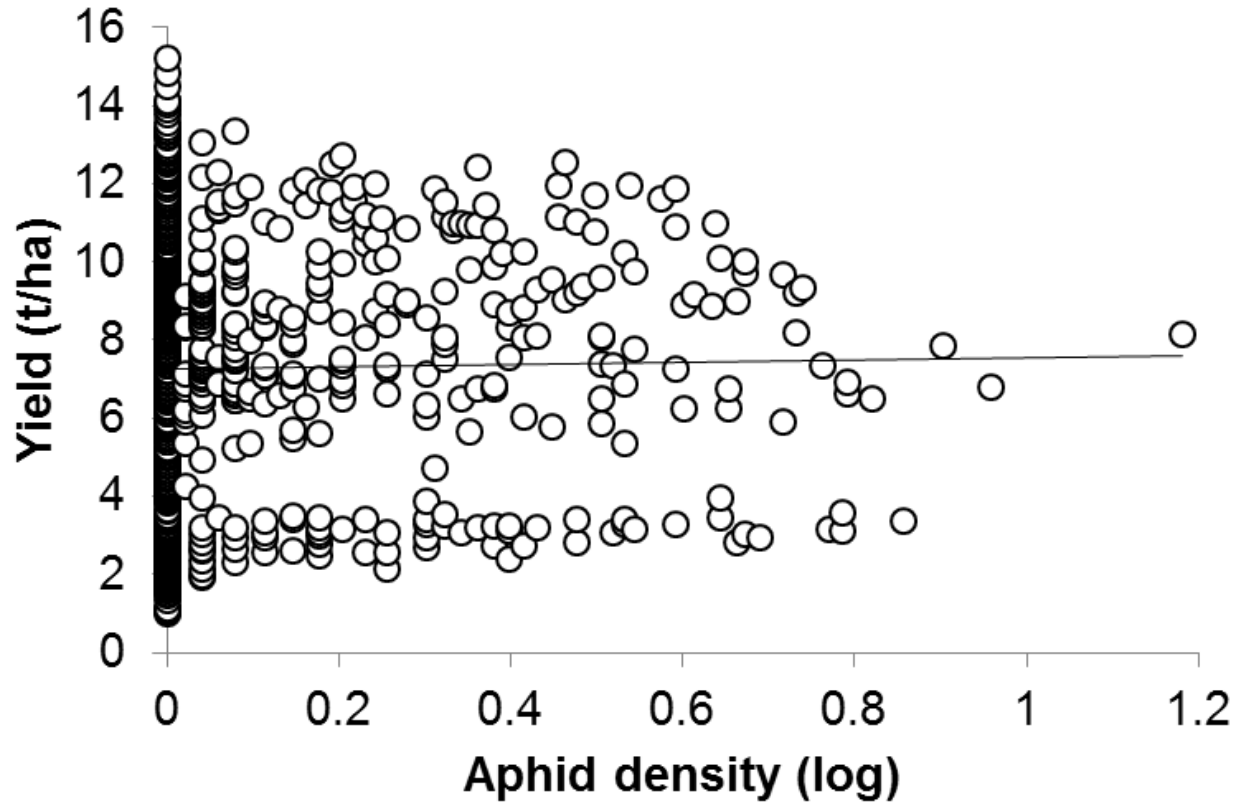


Example 2: Aphids in cereals

Alternatives:

- **Supporting natural enemies** (parasitoids, hover flies, ground beetles, spiders, ladybirds, entomopathogenic fungi,...)
- **Using aphid resistance (conv. plant breeding)**
- **Manipulating crop nutrition (N)**
- **Mulching**
- **Sowing time**
- **Intercropping, mixed cropping**
- **Spraying (biological) insecticides**

Example 2: Aphids in cereals



ORC winter wheat trials, 4 sites, 4 years

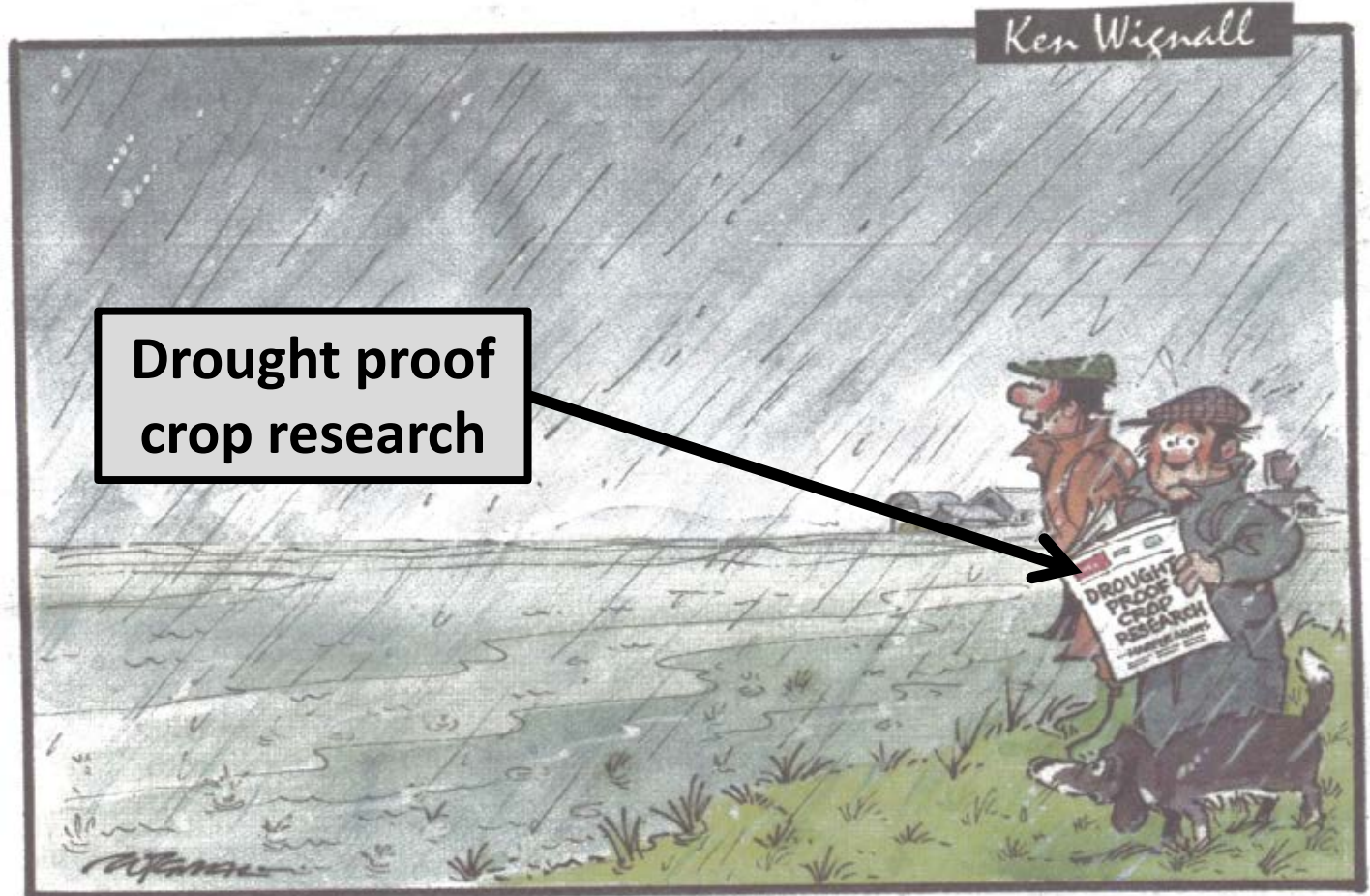
Example 2: Conclusions

- Do we need plant breeding for aphid control? **Yes.**
- Is aphid resistance (through plant breeding) the key factor for aphid control? **No.**
- Are there alternatives besides plant breeding? **Yes, plenty.**
- Do these alternative approaches deliver? **Yes, many do; some have additional benefits too.**
- What is needed? **Better dissemination, demonstration, cooperation.**

Example 3: Drought proof wheat

- Aim: drought proof wheat

Farmers' Guardian, 3.8.12, S.9



“It’s a good idea – providing they can find anywhere dry enough to test it!”

Example 3: Drought proof wheat

Alternatives:

- Conventional plant breeding
- Management of soil organic matter / plant residues
- Reduced tillage
- Crop rotation
- Contoured rowcrops, terracing
- Erosion-control structures
- Windbreaks and shelterbelts

But:

- Need to adapt to the **opposite** condition as well: need crop diversity to deal with it.

Example 3: Conclusions

- Do we need plant breeding for coping with droughts? **Yes.**
- Is heritable drought tolerance (through plant breeding) the key factor? **No.**
- Are there alternatives besides plant breeding? **Yes, plenty.**
- Do these alternative approaches deliver? **Yes, many do; some have additional benefits too.**
- What is needed? **Move away from single focus on drought.**

Conclusions

- **Carefully review aims – what do we want to achieve?**
- **Consider multiple functions of agro-ecosystems**
- **Consider diverse range of available solutions**
 - classic agronomy
 - ecosystem management
 - engineering communities (plant species diversity)
- **Improve knowledge exchange and support independent advice**

**Thank you very much
for your attention!**

