

# *Phytophthora* management in potato cultivation: an example of a complex social-ecological system

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WAGENINGEN UR  
For quality of life

# The Netherlands and late blight

- High infection pressure
  - Maritime climate
  - High potato density
- Problem
  - Annual losses of 125 M€
  - 10-15 fungicide applications/season
  - Decrease in organic potato production
- Sanitary regulations
  - Yellow/Red Cards
  - Anonymous hotline



The Netherlands



Late blight infection



# Objectives

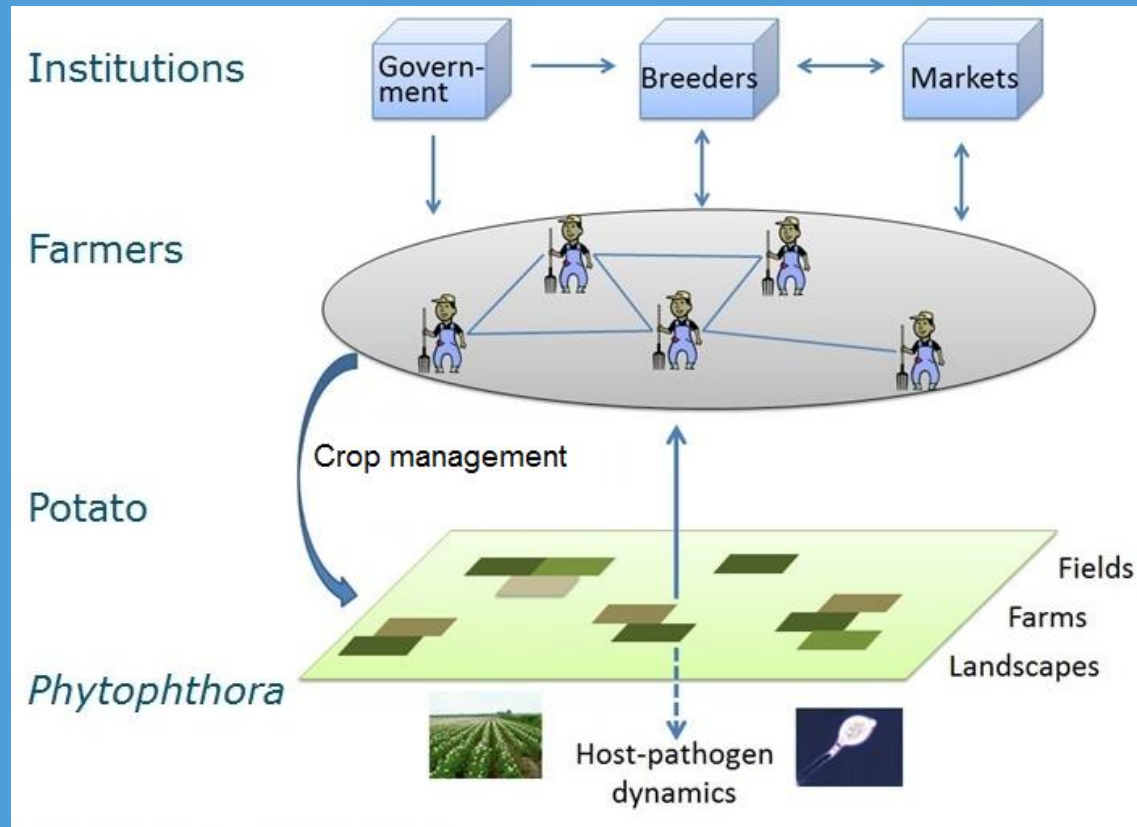
*How can actors join forces to achieve sustainable management of *Phytophthora infestans* by using resistant cultivars?*

- i. Analyse *Phytophthora* management as social-ecological system
- ii. Analyse systems dynamics → development of an agent-based model (ABM)
- iii. Scenario testing with ABM's
- iv. Model use/gaming with stakeholders



# Method: Social-ecological system

- Multi-disciplinary research
- Interaction: within and between levels
- Feedback mechanisms: learning & adaptability
- Self-organisation



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# Method: Analyse system components

- Social factors
  - In-depth interviews
    - Farmers
    - Breeding/Trading companies
    - Experts
- Ecological factors
  - Literature

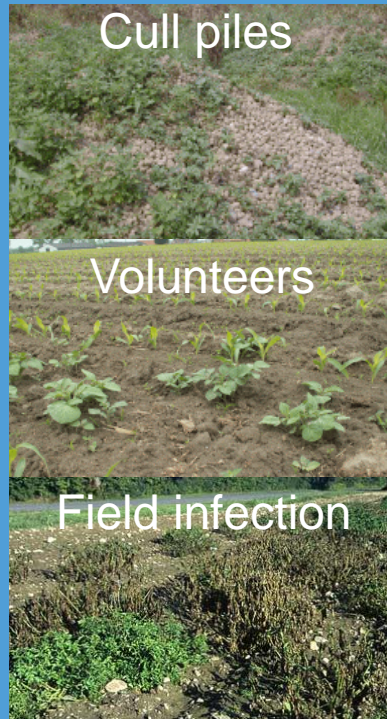


# Phytophthora management

- Main management strategies:



Fungicide application



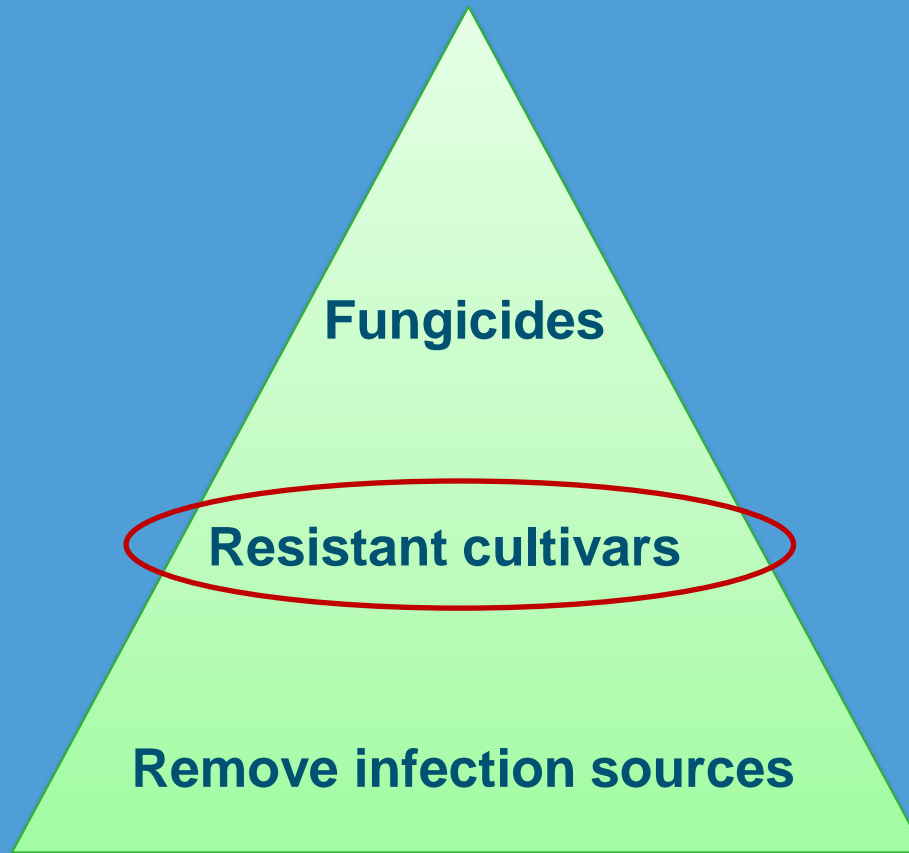
Removal of  
infection sources



Resistant cultivars



# Towards sustainable management



(Schöber, 1992)



# Resistant cultivars

- Many R-genes (*S. demissum*) have been broken (1950)
- Long breeding process ( $\pm 20$  years of introgression)
- Discovery of new R-genes in other *Solanum* species
- Protect new varieties for breakdown of resistance
  - Resistance management



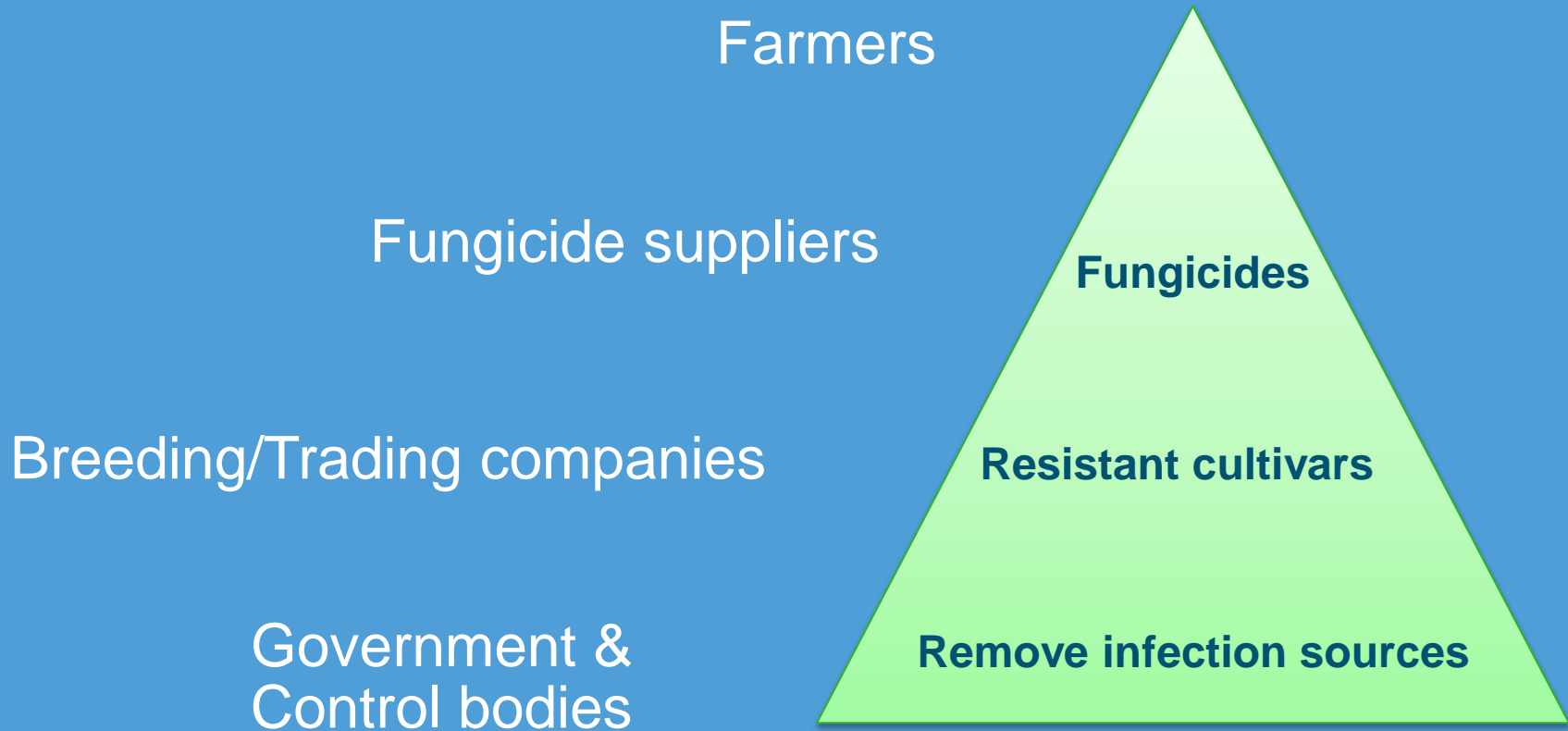


# Resistance management strategies

- Stacking of R-genes
- Protect resistant cultivars with fungicides
- Cultivar allocation strategies
  - Diversification of cultivars (with different R-genes)
    - Mixtures
    - Spatial/Temporal



# Involved stakeholders



# Farmers: *Phytophthora* management

	<b>Conventional</b>	<b>Organic</b>
Rotation	1:2-1:4	1:6-1:8
<i>Phytophthora</i> management	Fungicides	Presprouting Early/Resistant varieties (Copper spraying)
Biggest problem in potato production	Bacteria, Nematodes e.g.	<i>Phytophthora</i>

- Differences in *Phytophthora* management
- Related to personal characteristics:  
Risk-perception, innovativeness, accuracy, economic incentives and environmental care



# Farmers: Cultivar selection

## ■ Resistant cultivars

- Positive

- Smaller risk for infection

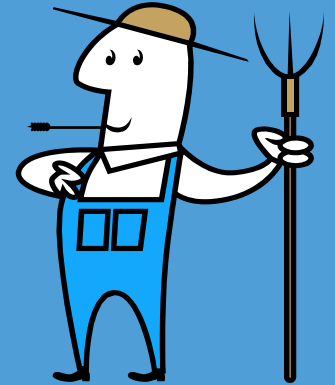
- Less fungicides → less costs & time

- Negative

- Market acceptance

- Other characteristics (yield etc.)

- Fungicide application is easy & cheap



# Breeding/Trading Companies

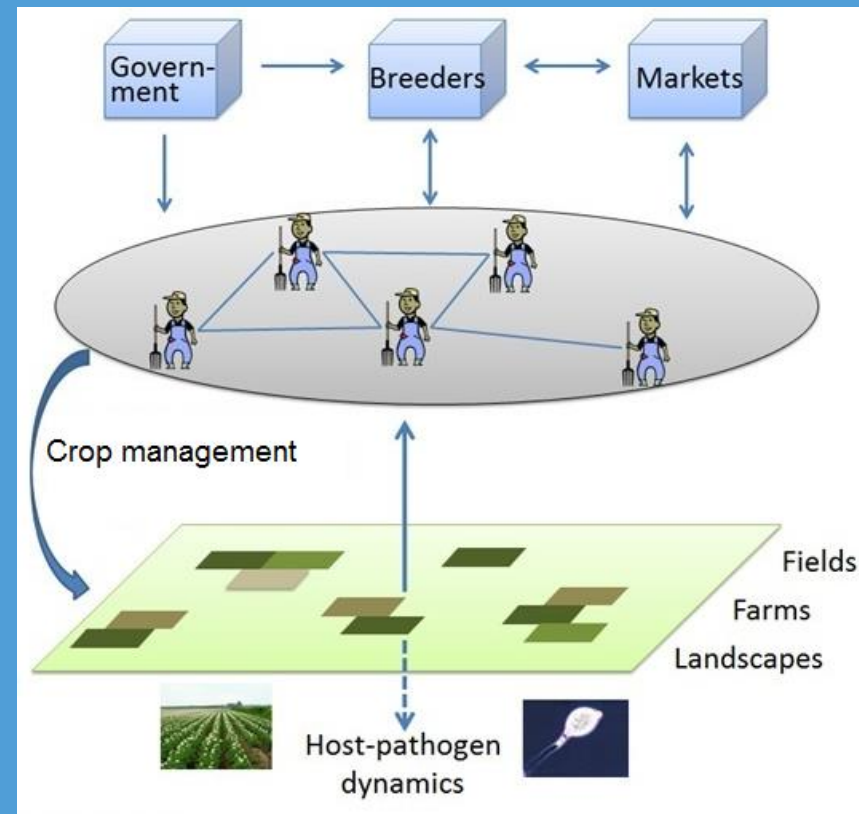
- Current new resistant cultivars
- Follow market demands
- Competition
- Farmers buy and sell from companies

Company	Resistant cultivar
Agrico	Carolus
Agrico	Athlete
KWS	Vitabella
Meijer	Bionica
Danespo	Sarpo Mira



# Conclusion

- *Phytophthora* infection is the result of both social and ecological processes
- Many stakeholders play a role in *Phytophthora* management
- Resistant cultivars are important for sustainable management:
  - Small market
  - Resistance management



Thanks for your attention!

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