



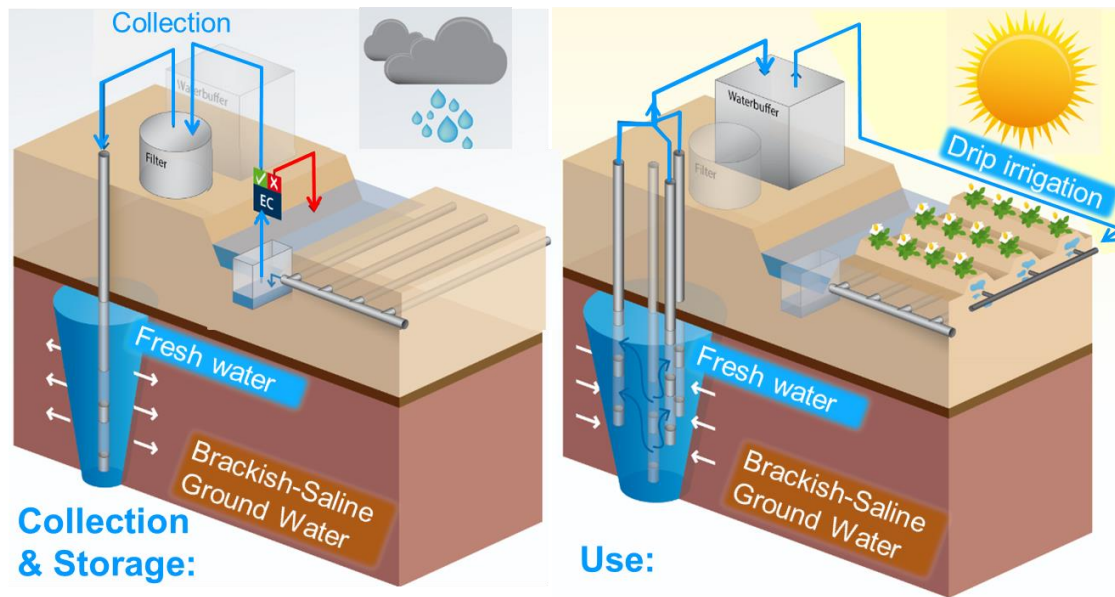
AGRIMAR:

Drainage Water Recycling for Irrigation &
Surface Water Quality Protection



Dr. Boris van Breukelen (Coordinator; Supervisor)
Emiel Kruisdijk (PhD student: chemische waterkwaliteit)
Carina Eisfeld (PhD student: plant pathogeen verwijdering)

Onderzoeksvragen (Algemeen)



- Grondwater vervuiling door nutriënten en gewasbeschermingsmiddelen? Mate van afbraak/vastlegging? Is hergebruik mogelijk?
- Systeem vrij van plant pathogene bacteriën? Veilig water voor irrigatie?
- Verbetering oppervlaktewaterkwaliteit?

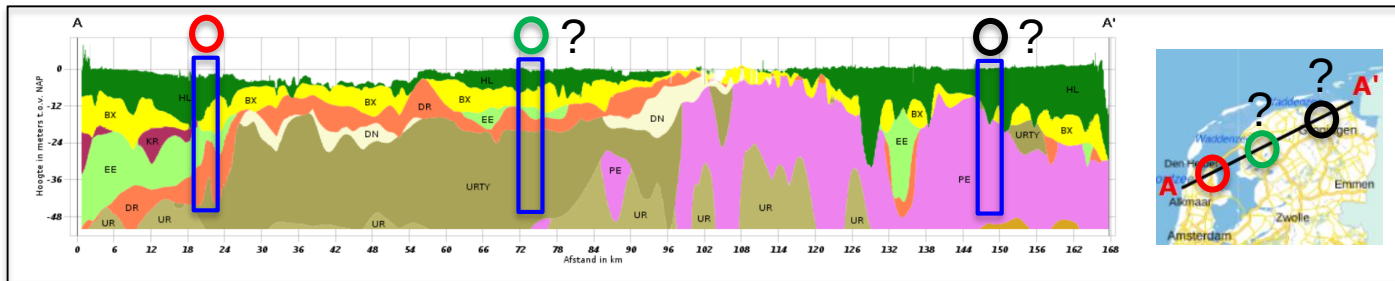
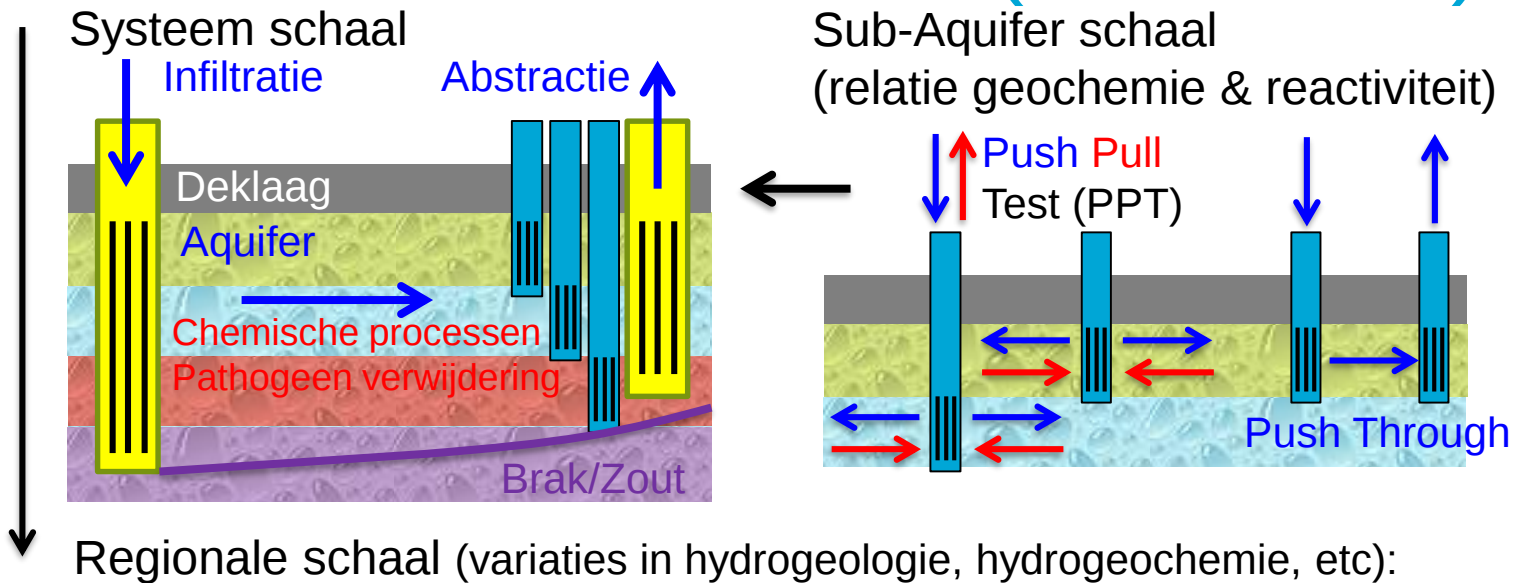
Onderzoeksvragen (Specifiek)

- Chemische Waterkwaliteit:
 - Afbraak gewasbeschermingsmiddelen? Hoe snel? Relatie met redox condities?
 - Omzetting/vastlegging nutriënten? Welke biogeochemische processen?
- Biologische Waterkwaliteit:
 - Verwijderingsprocessen plant pathogenen tijdens transport door aquifer? Sterfte? Filtratie?
 - Kans op infectie gewassen? Hoe laag risico?

Doel

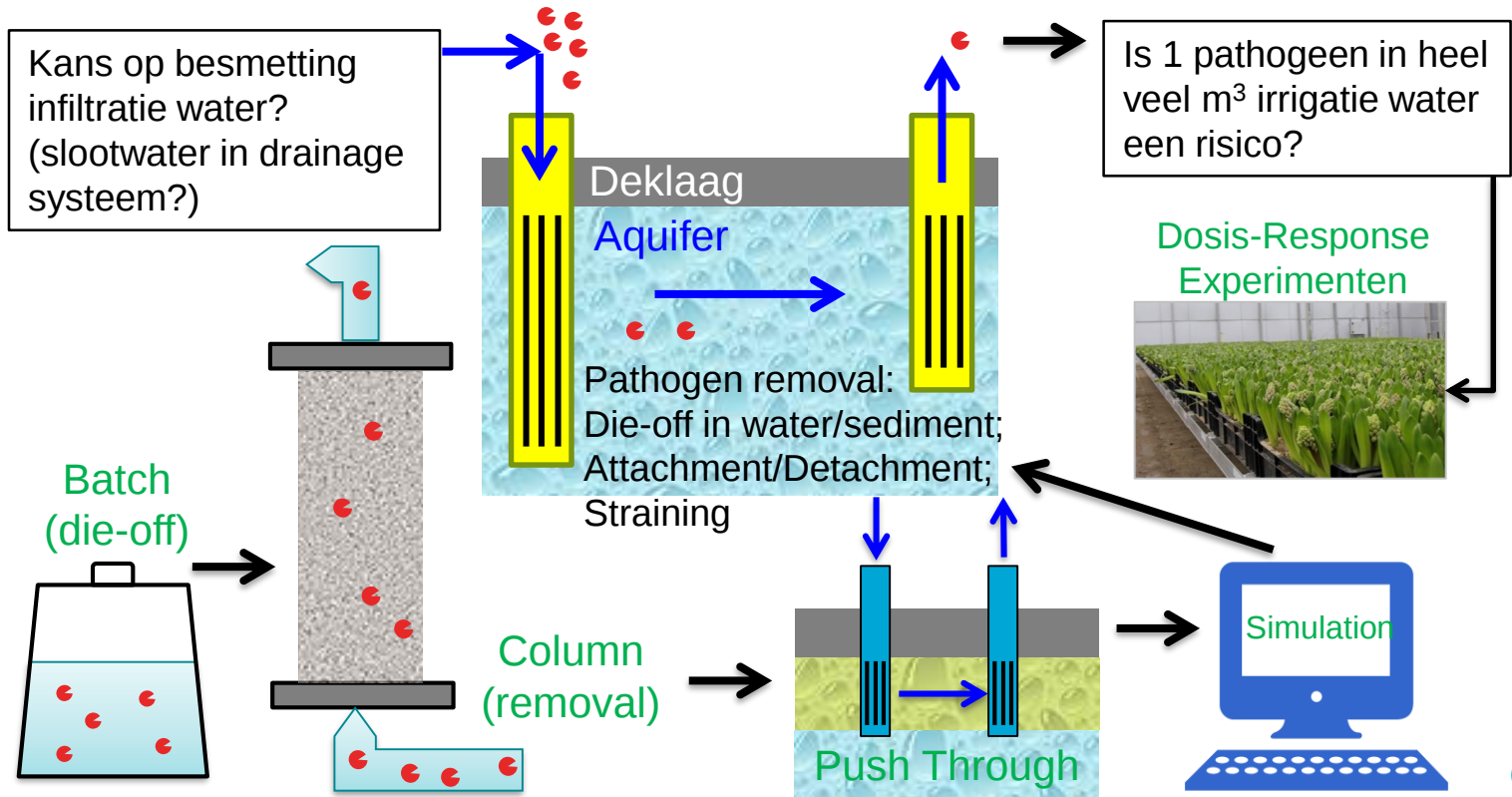
- Inschatting waterkwaliteitseffecten:
 - Intensief meetprogramma nieuwe 10ha MAR locatie
 - Specifieke veldtesten naar reactiviteit & verwijdering
 - Ontwikkeling computersimulatie model:
 - Simulatie waterkwaliteit MAR locatie
 - Optimaal ontwerp (chemisch & biologisch)
 - Prognose prestaties op regionale schaal
- Inschatting risico's plant pathogenen:
 - Verwijdering in MAR systeem (lab en veld testen)
 - Ontwikkeling integrale risico analyse (QMRA)

Onderzoek Methoden (Chemisch)



Onderzoek Methoden (Biologisch)

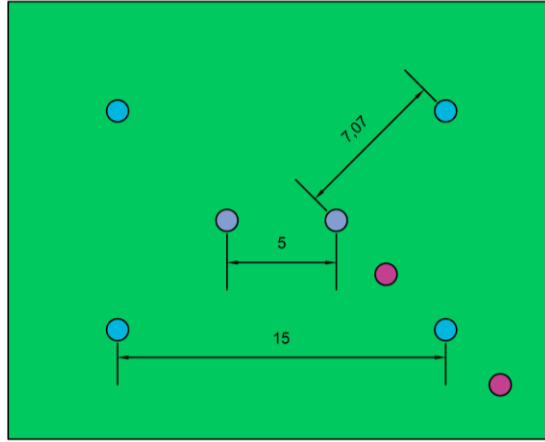
Quantitative Microbial Risk Assessment (QMRA)



Nieuw MAR systeem

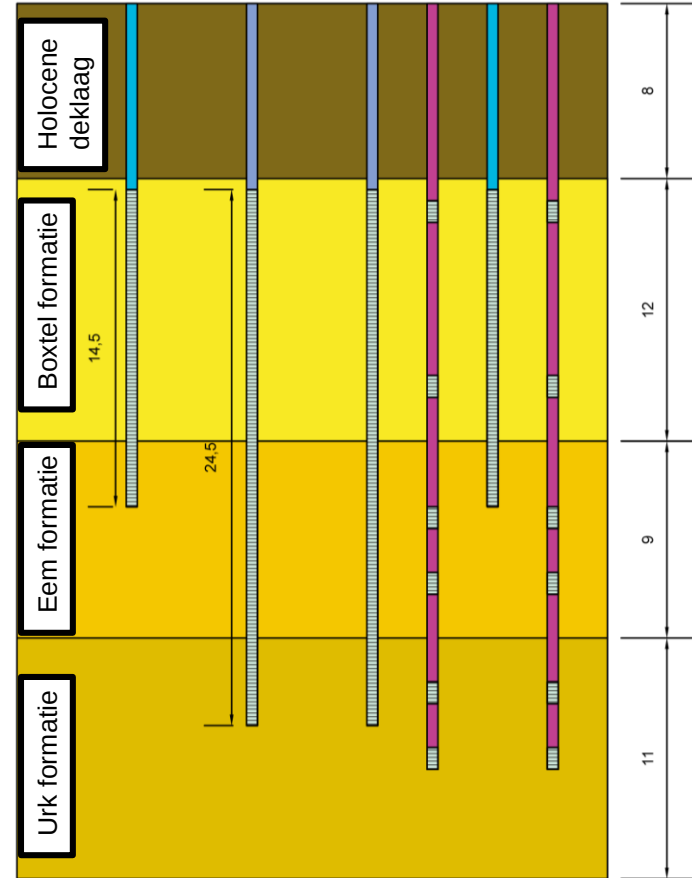


Bovenaanzicht

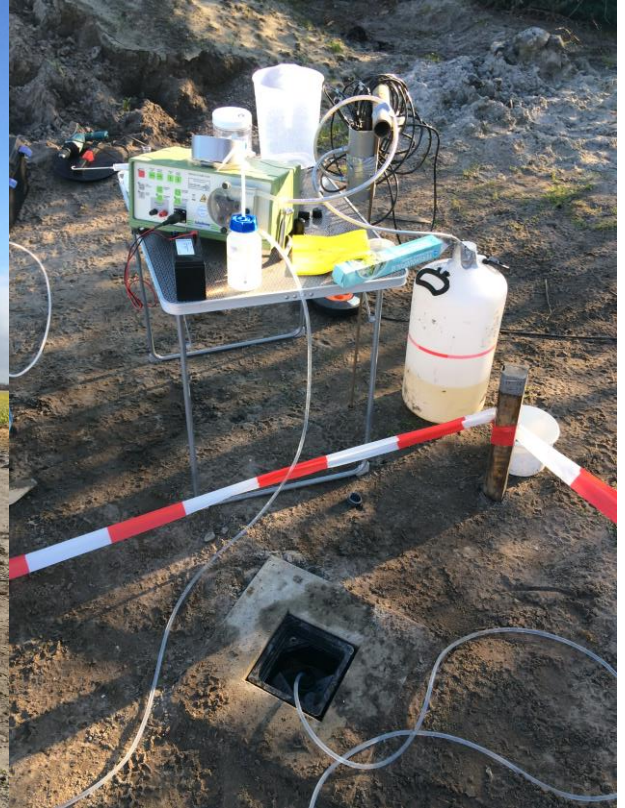
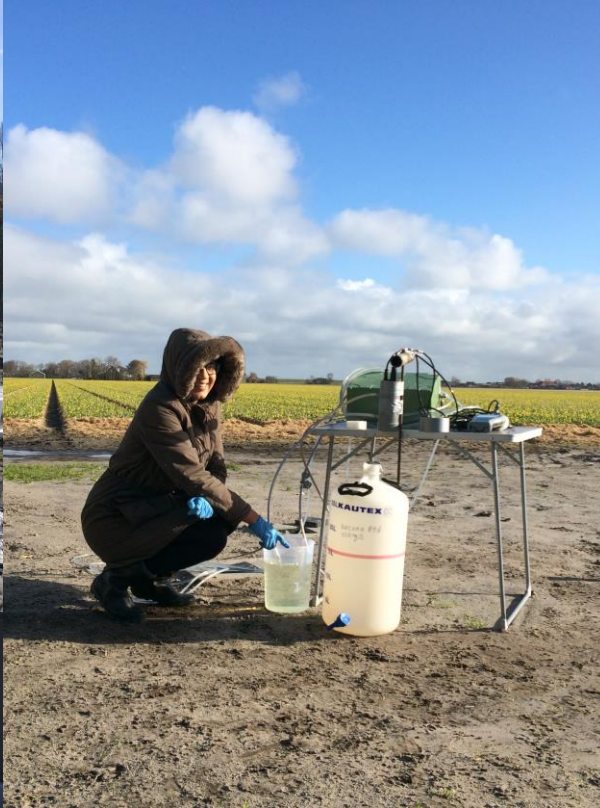
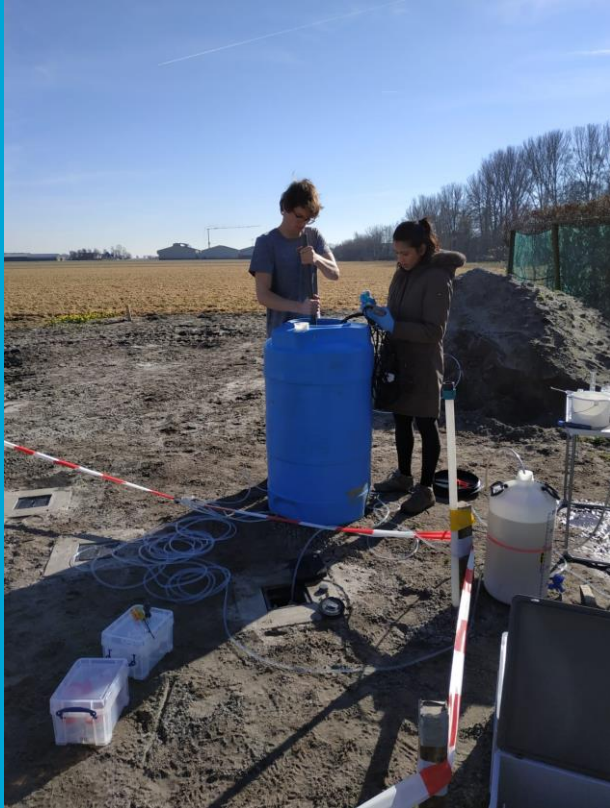


-  Infiltratieput
-  Onttrekkingsput
-  Monitoringsput
-  Filter

Doorsnede



Initiële condities



Monitoring

Monitoren infiltratie en
onttrekkingswater:

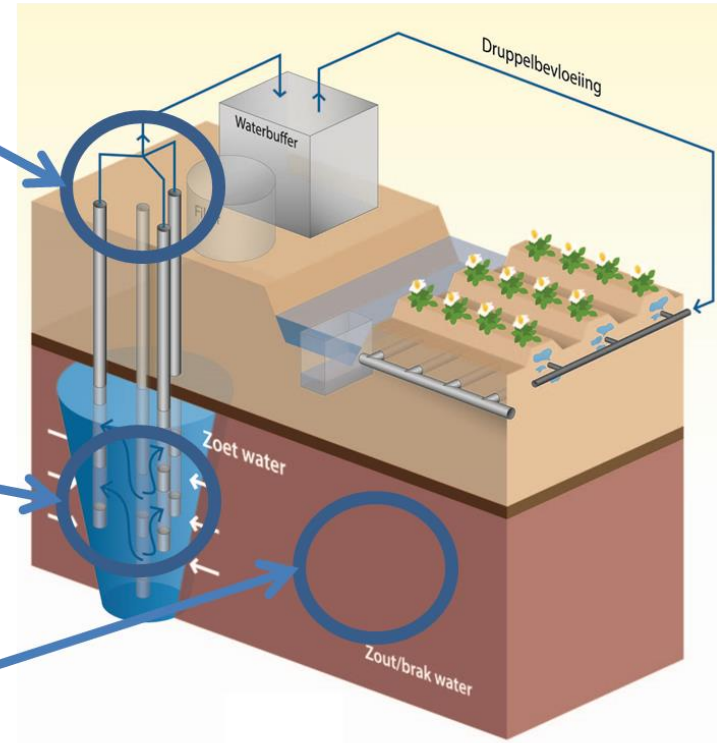
- Volumes in en uit
- Real-time sensors
- Analyse watermonsters

Monitoren grondwater:

- Real-time sensors
- Analyse watermonsters

Monitoring aquifer:

- Analyse bodemmonsters



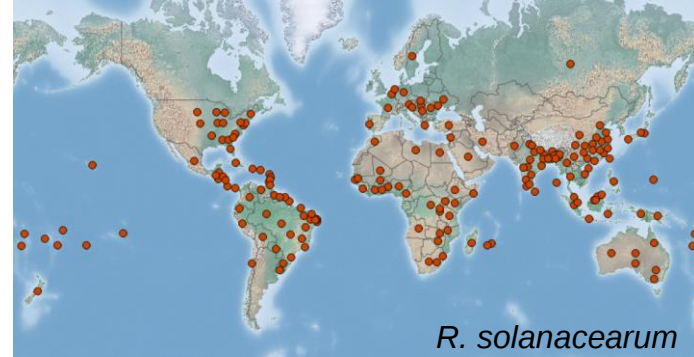
Selected bacterial pathogens

Ralstonia solanacearum phylotype IIb (IPO1828rif)

Dickeya solani IPO2266 (strep)

Pectobacterium carotovorum IPO1990 (strep)

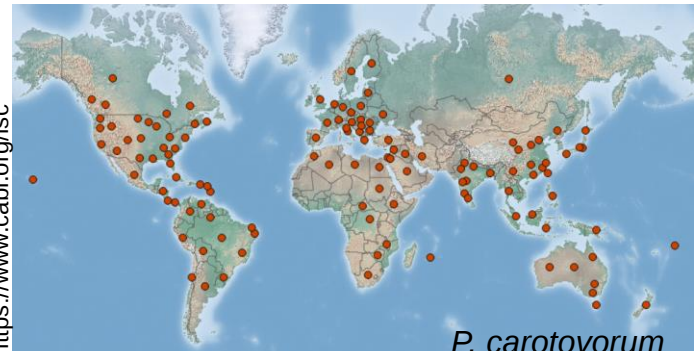
- Broad host range
- Survival in water and soil
- Symptoms: brown rot, blackleg, soft rot



R. solanacearum



D. solani



P. carotovorum



<https://www.cabi.org/isc>

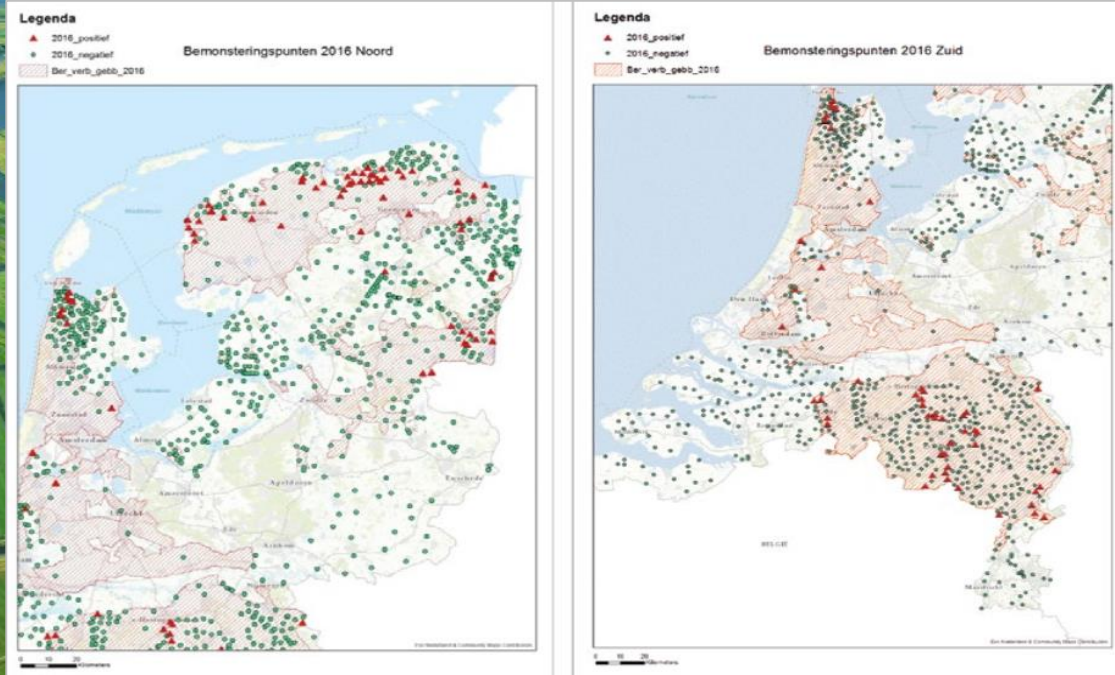
R. solanacearum in surface waters

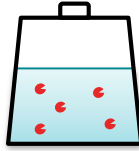
Surface water quality → Contamination with plant pathogens → irrigation water as disease inoculum



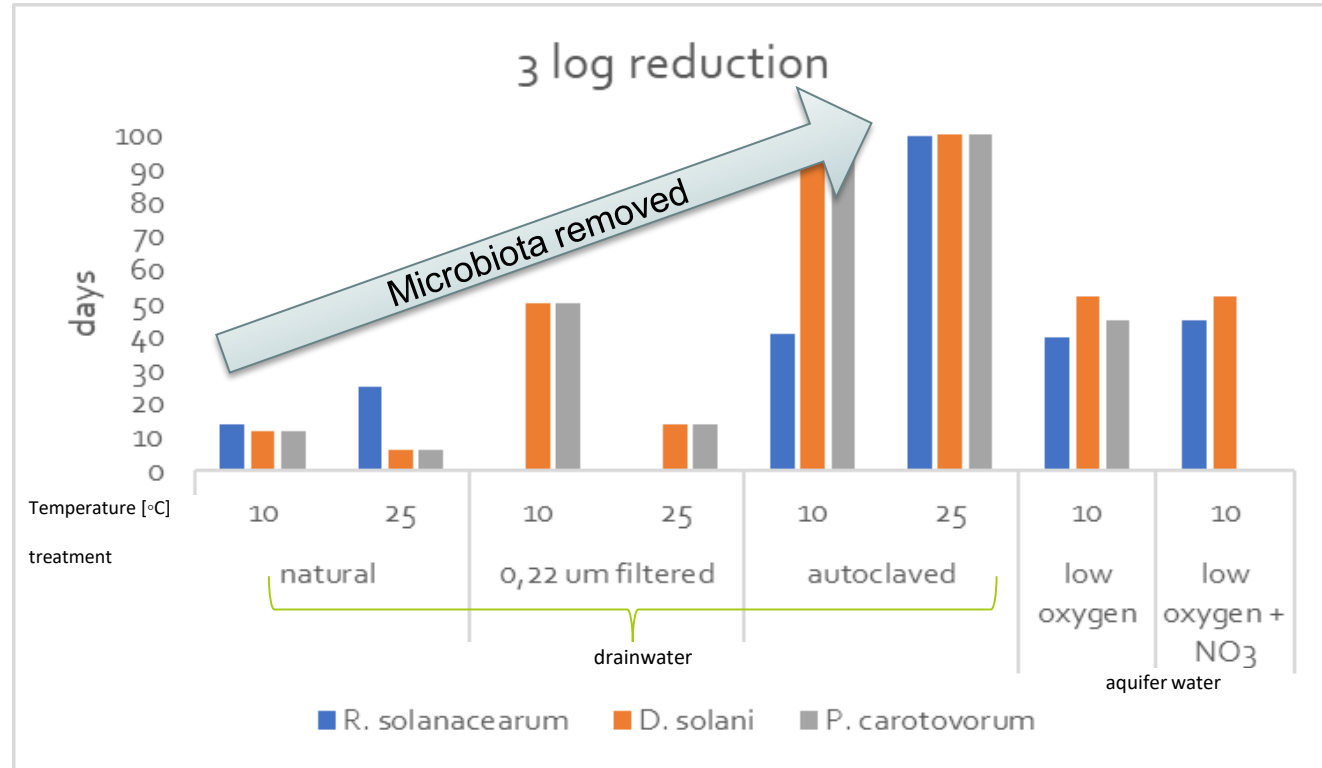
NVWA tests surface waters 2x per year: no findings (●)

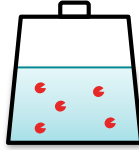
Ralstonia solanacearum found (▲) – restricted irrigation



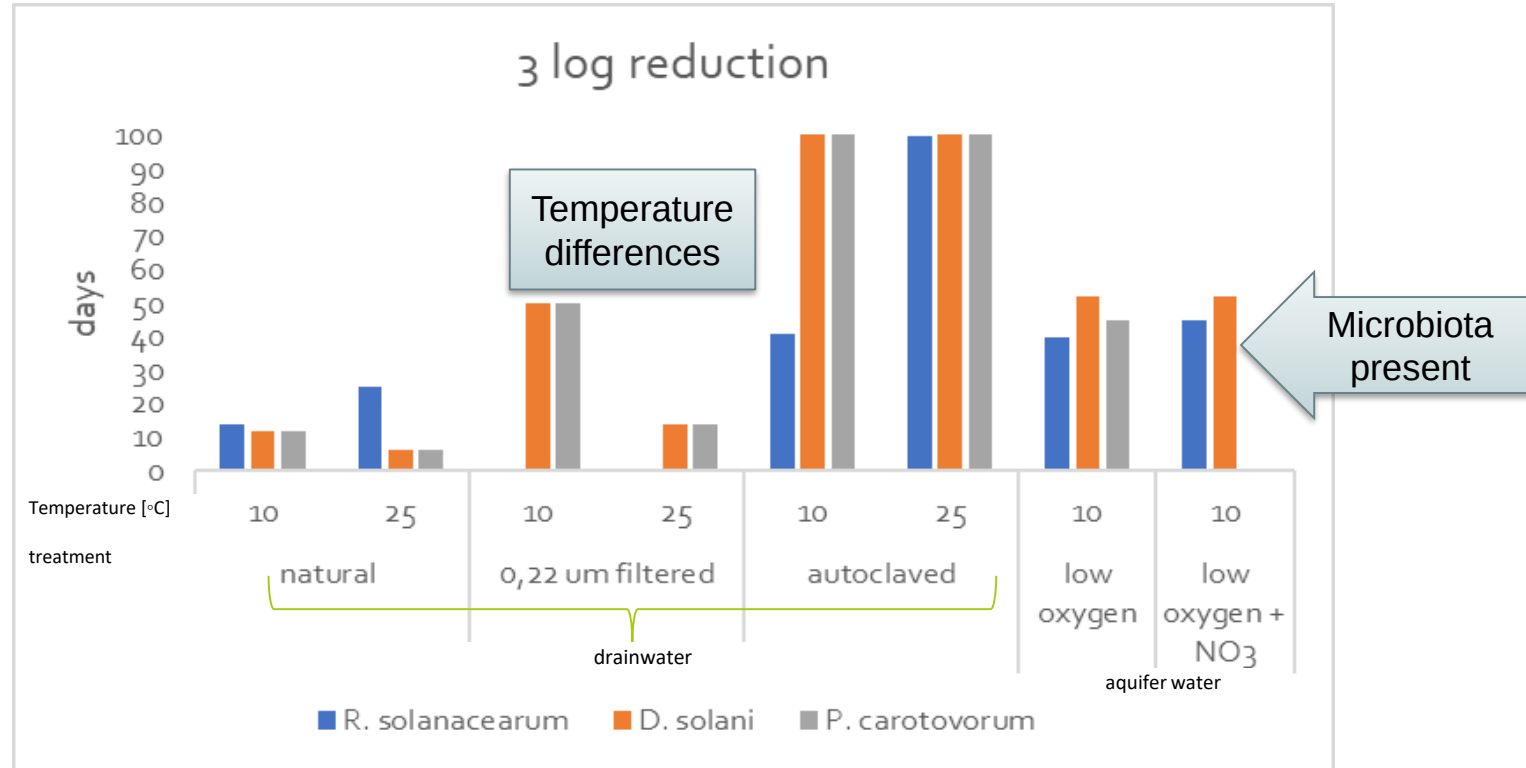


Results – Survival in water





Results – Survival in water



Outlook

Quantitative scientific data

- Treatment efficiency of soil passage
Lab + Field scale
- Dose-response
(infective dose and acceptable risk?)



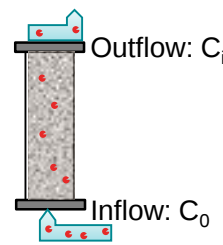
QMRA



Quantitative microbial risk assessment

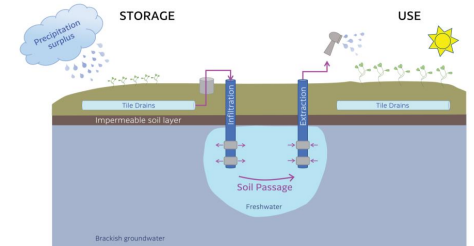


Water safety management



Soil column – Bacterial transport

Field-scale pathogen removal



Greenhouse: Dose-response

Hyacinth
+
Pectobacterium

Potato
+ Ralstonia



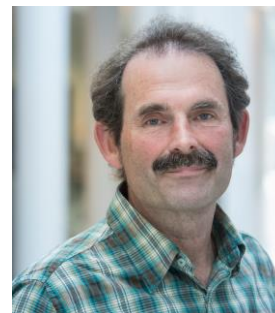


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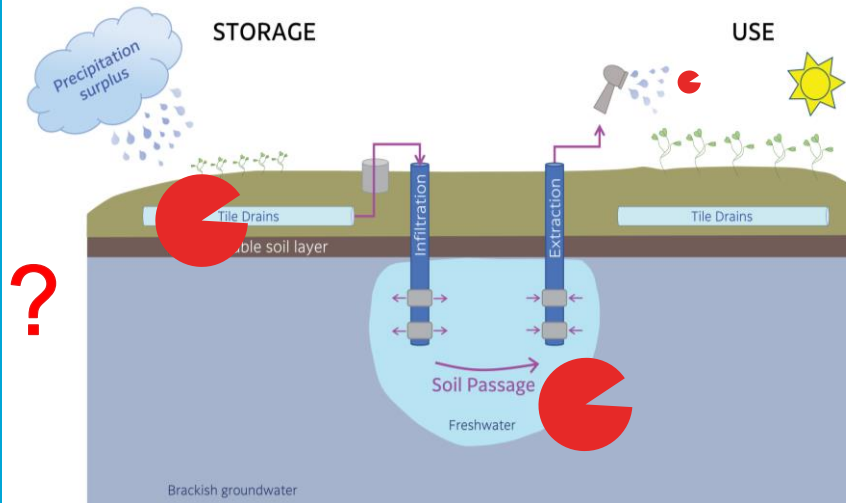
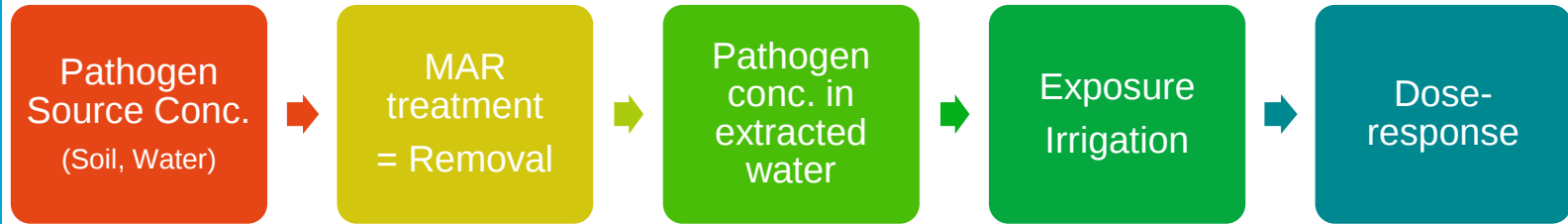
Gertjan Medema
Promotor Carina



Jan van der Wolf
adviser Carina

Onderzoek Methoden (biologisch)

Quantitative Microbial Risk Assessment (QMRA)



QMRA:

→ How high is the infection risk when irrigated with MAR treated water?