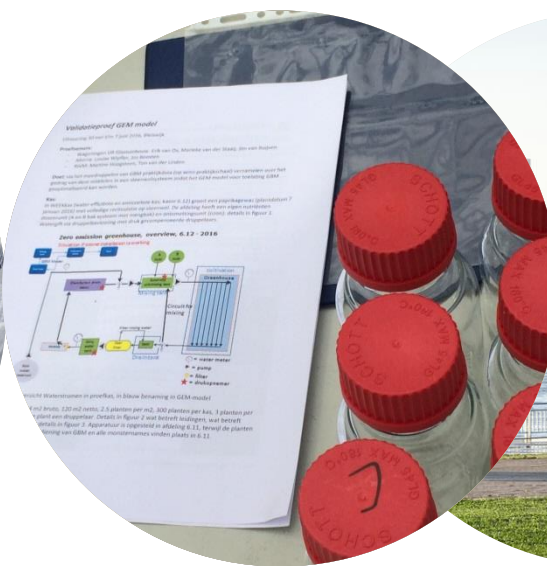
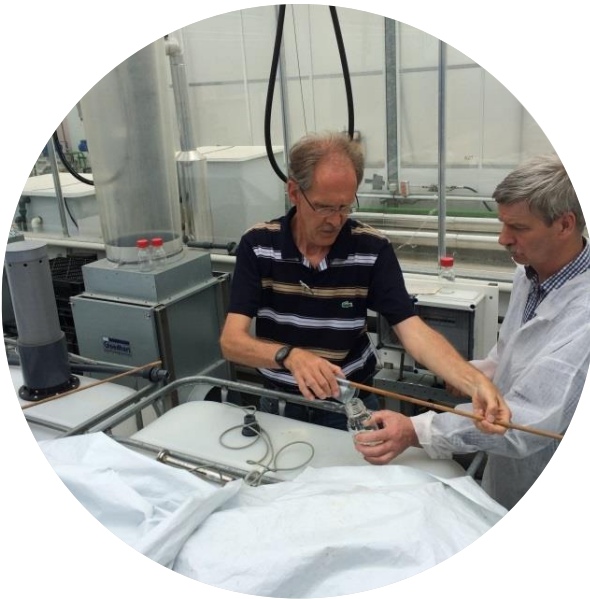


# Testing of the Greenhouse Emission Model for a Dutch soilless growing system

1 September 2017, Louise Wipfler

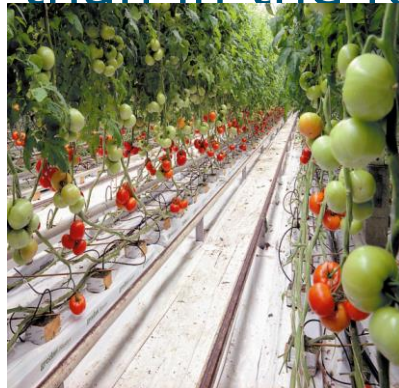


# Presentation of work by working group

- Wageningen UR: Louise Wipfler, Jos Boesten, Erik van Os, Marieke van der Staaij
- RIVM: Ton van der Linden, Martine Hoogsteen

# Background

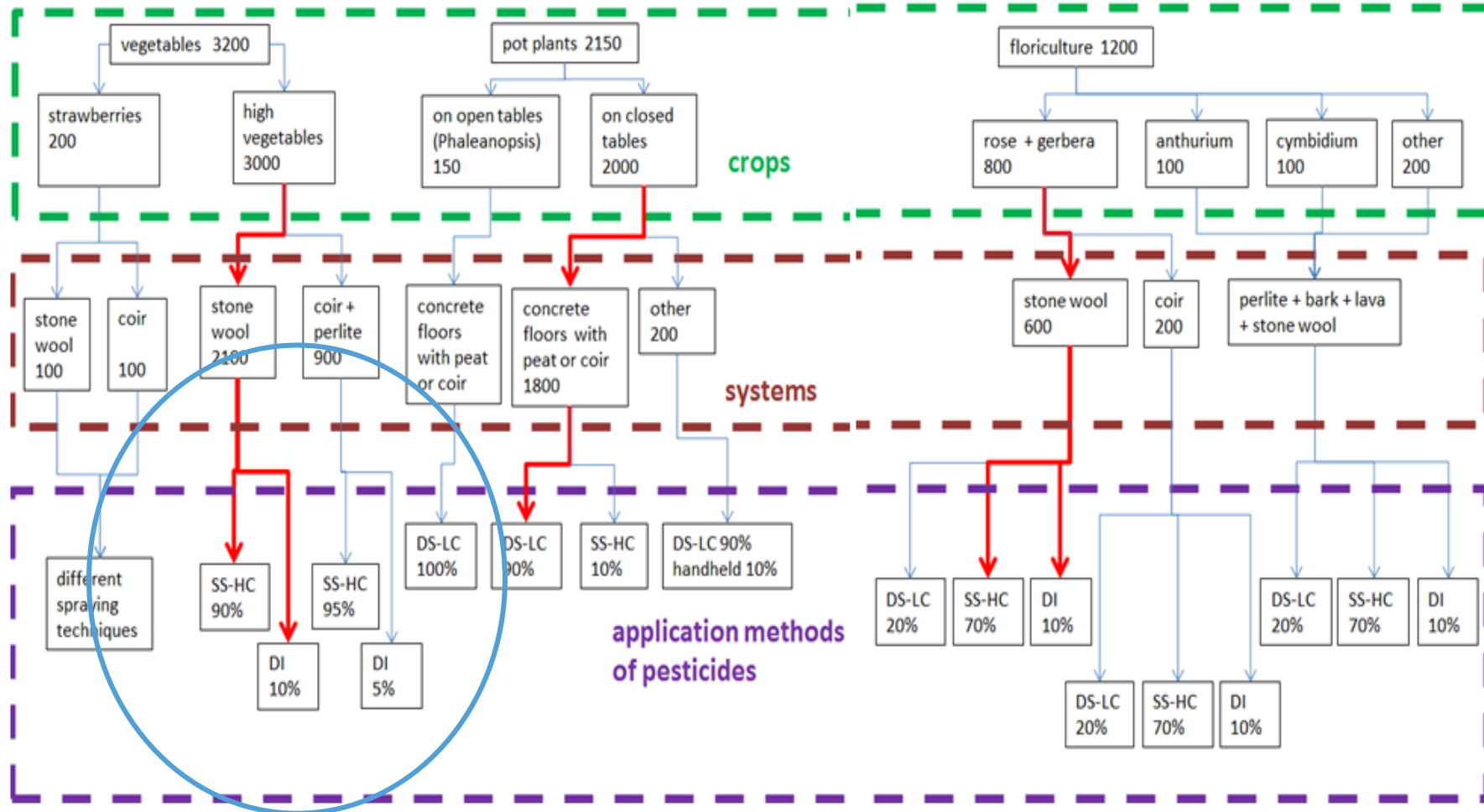
- Important economic sector for the Netherlands
- Since 2016: Greenhouse Emission Model is use in registration
- GEM is instrument to calculate concentrations in surface water and groundwater due to pesticide use in greenhouses in NL
  - Soilless cultivation
  - Soil bound cultivation
- Predicted Environmental Concentrations for soilless are much higher than in the former assessments



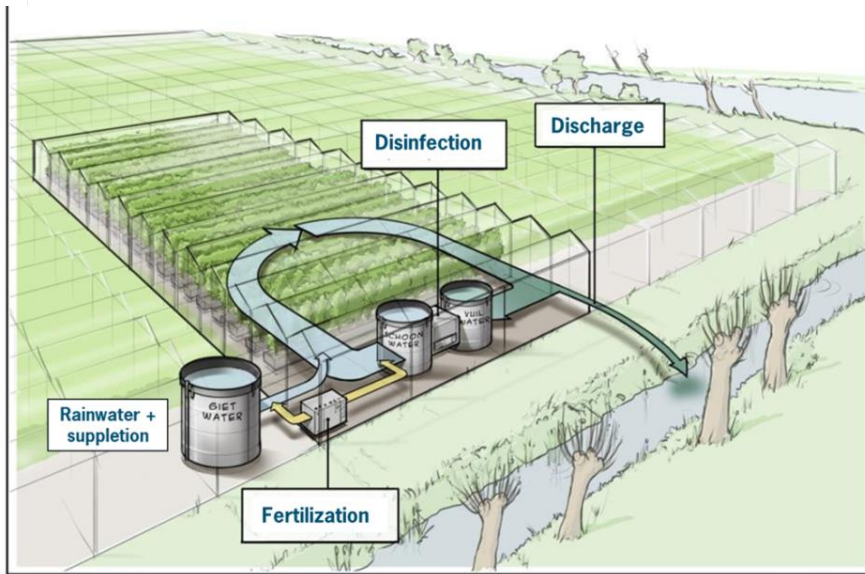
# Testing of the model

- Request by stakeholders
- Aim: to compare the Predicted Environmental Concentration (PEC) calculated by GEM with concentration measured under real conditions
- But: What are the 'real' conditions?

# Soilless cultivation (ha) in NL → which system?



# Model concepts (1)



- **WATERSTROMEN MODEL** predicts:
  - water needs based on greenhouse climate conditions
  - drainage flows and discharge (filter rinsing water & discharge of deteriorated water)
- Water volumes are input to substance emission model

# Model concepts (2)

- Substance Emission Model: PPP fate
  - Number of connected ideally mixed tanks
  - Degradation via first order kinetics, formation of metabolites
  - Plant uptake assumed to depend on  $K_{ow}$  of PPP (Briggs)
  - Differentiation between slabs and ebb/flow systems (pot plants)
  - Input to TOXSWA

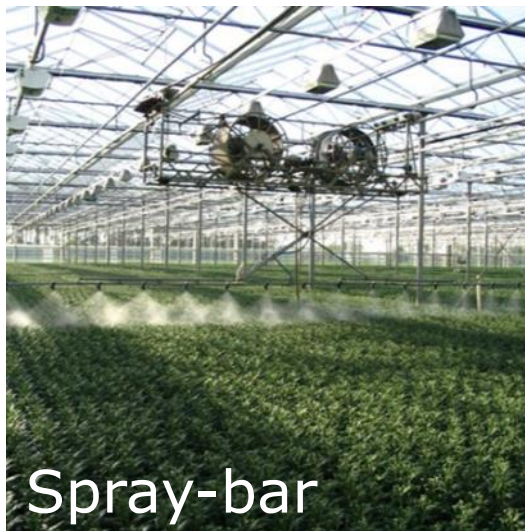


# Model concepts (3)

- Substance Emission Model: PPP fate continuation
  - Application via nutrient solution (dripping) or via spraying, fogging or low volume mister
  - Spraying: pesticides in condensation water (glass) collected and added to recirculation water



dripping



Spray-bar

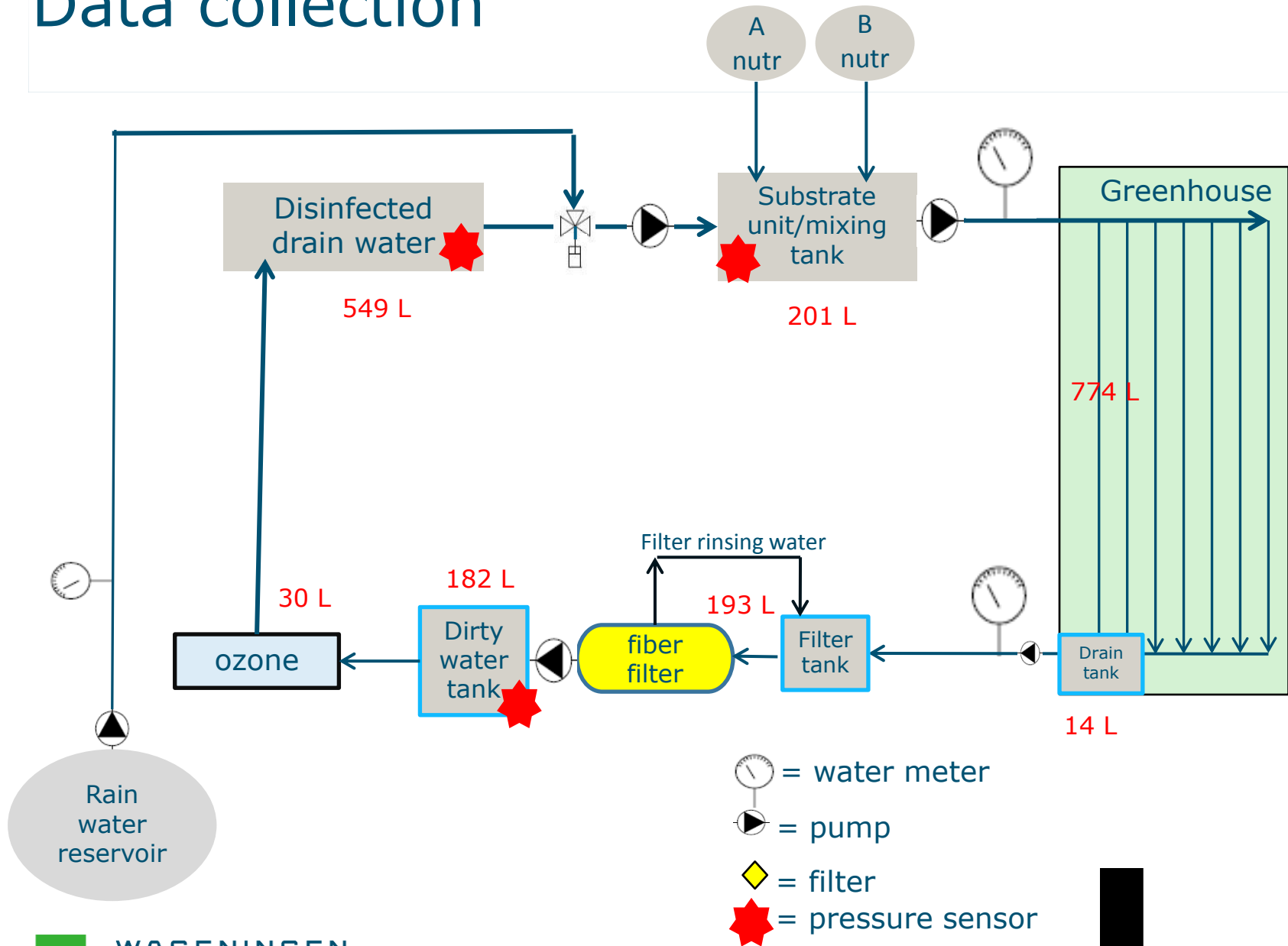


# Experimental set up

- Experimental site in Bleiswijk, 120 m<sup>2</sup> net greenhouse
- Drainwater is recirculated and passes ozone installation for disinfection
- No discharge of recirculation water during experiment
- Sweet pepper, planted 7/1/2016,
  - 2.5 pl/m<sup>2</sup>, 300 pl/greenhouse, 3 pl/stone wool slab
- Start experiment at 31/5 and end at 7/6.
- Pesticide applied via dripping application according to label on 31/5 at 10 am:
  - pymetrozine (Plenum), 15 g/1000pl, 50% a.i.
  - imidacloprid (Admire), 14 g/1000 pl, 70% a.i.



# Data collection



# Data collection

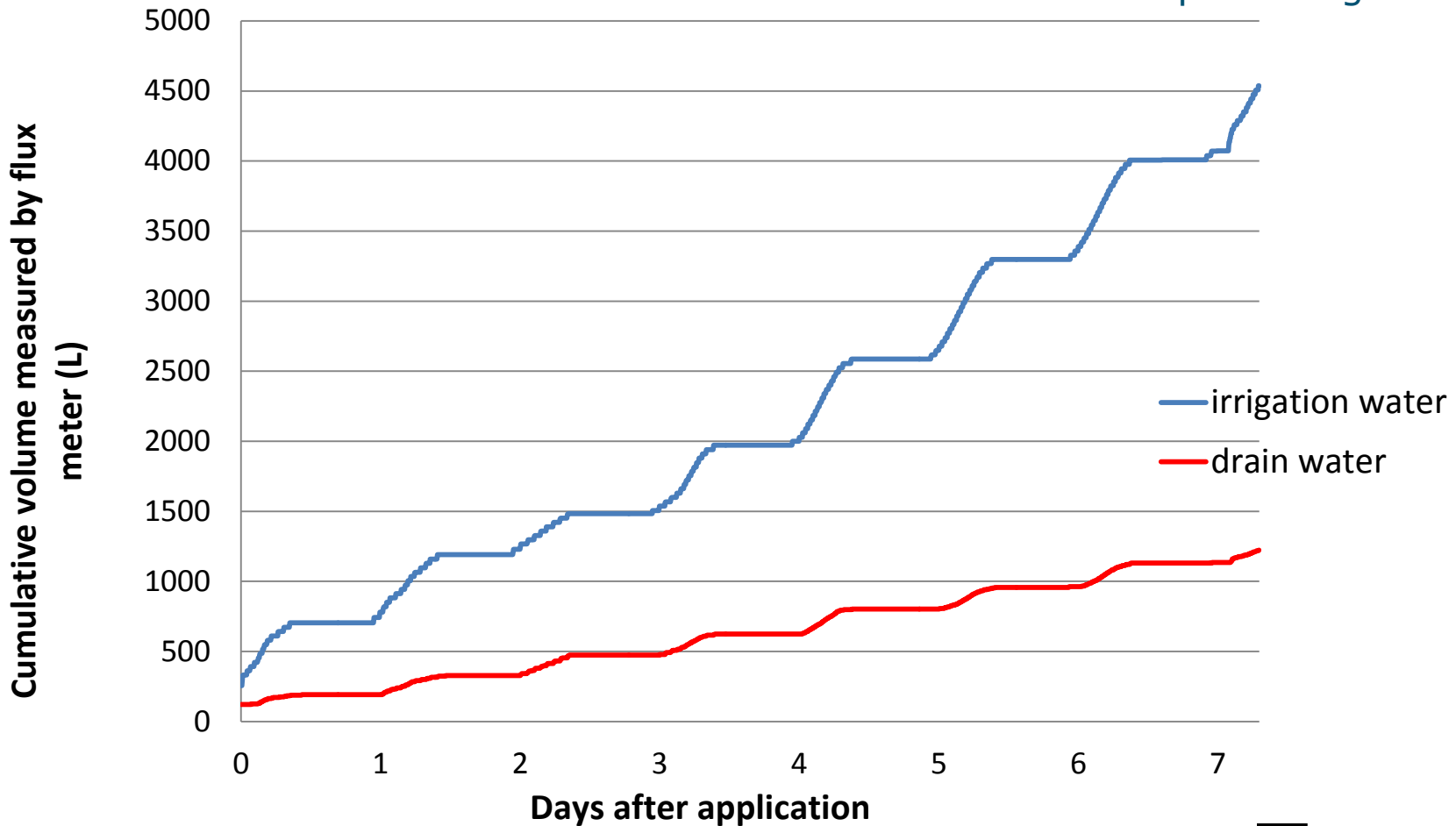
## At start of experiment

Initial volume in each tank

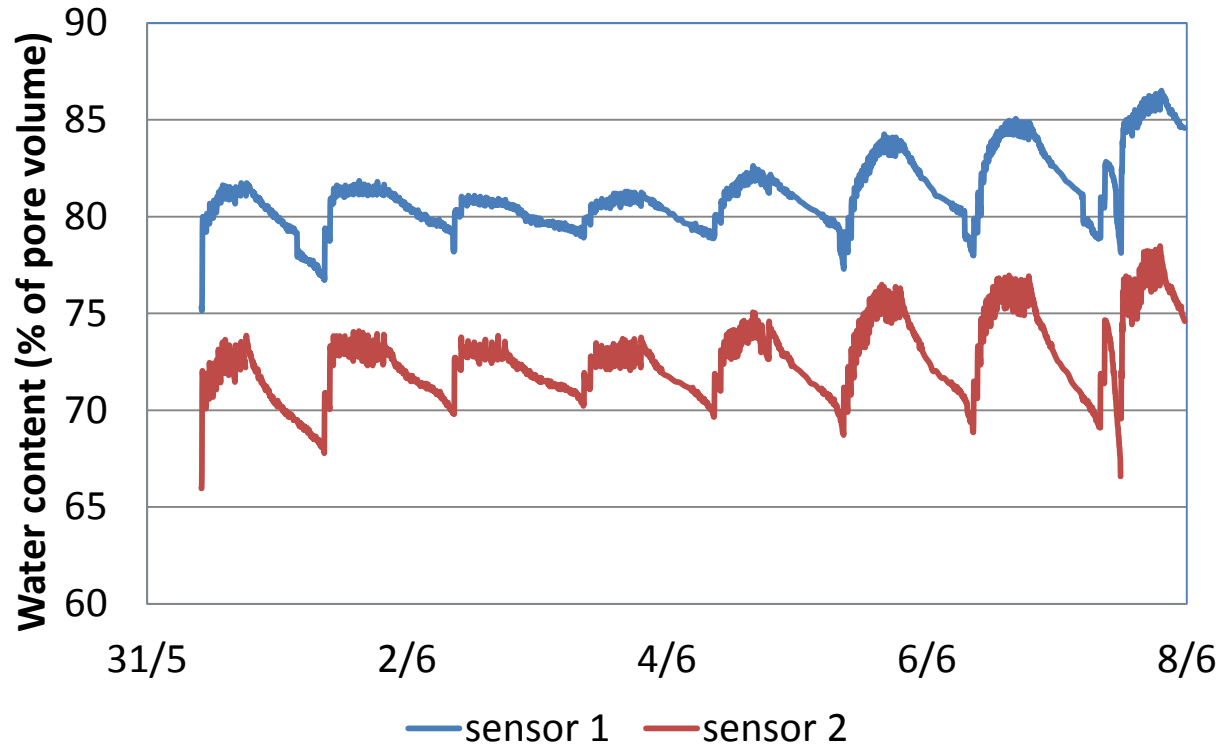
Measurement type	frequency
Pressure sensors in 3 tanks	5 min
3 Water meters	5 min
<i>Lets-grow</i> database Irrigation timing, radiation, temperature, humidity	5 min
PPP sampling in duplicate -- between 8-17 hr	Day 1+2: 2 hours Day 3+4: 3 times Day 5-7: daily
water content in slabs	3 min

# Water flows (cumulative)

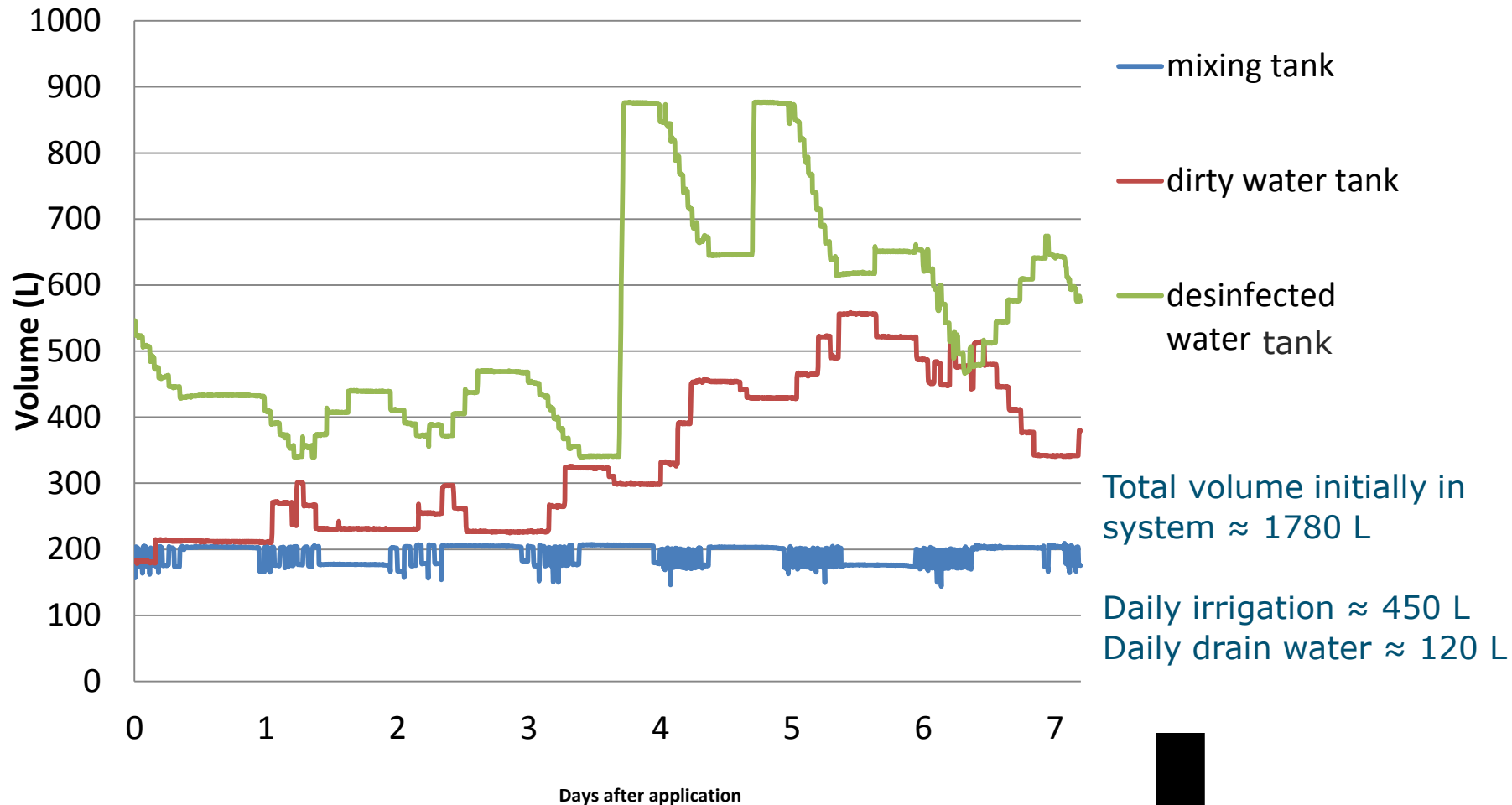
- Drain percentage of 27%



# Slabs

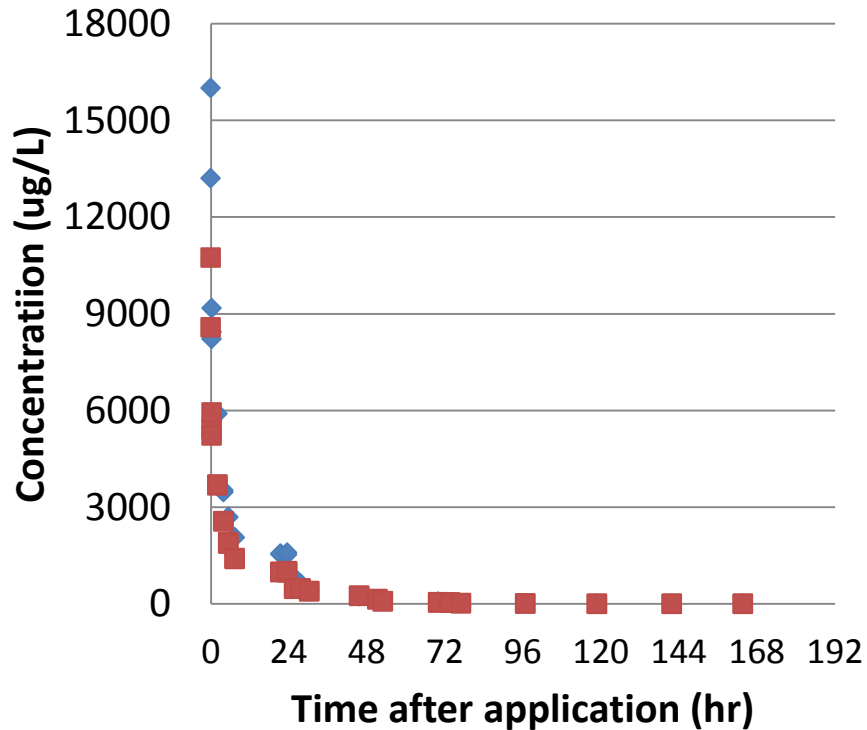


# Water in tanks (pressure sensors)

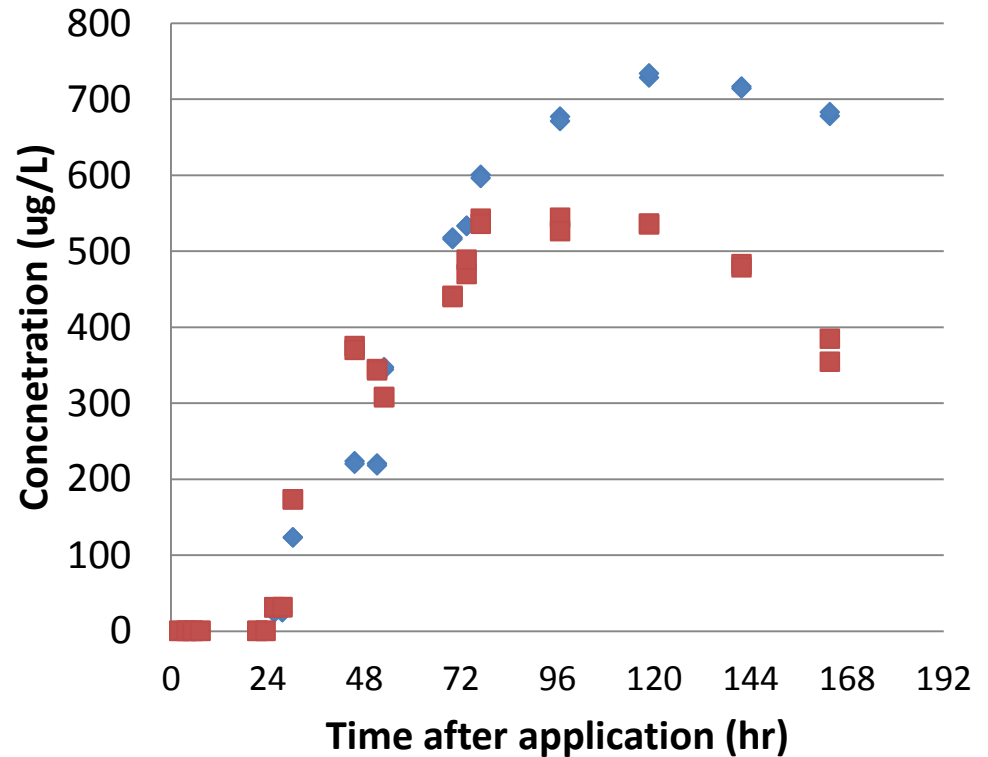


# Measured concentrations

## ■ mixing tank



## ■ dirty water tank

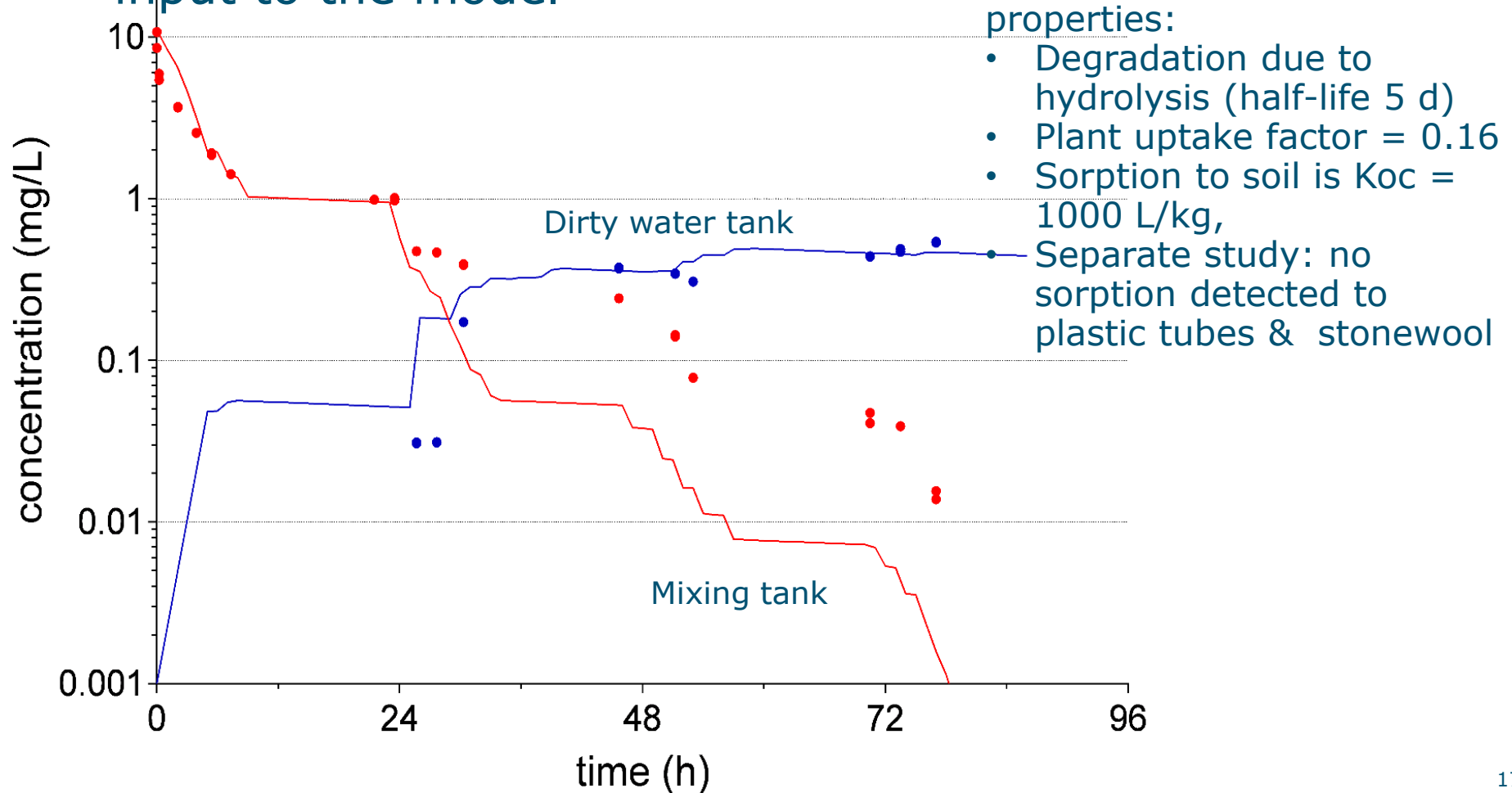


◆ Imidacloprid ■ Pymetrozine



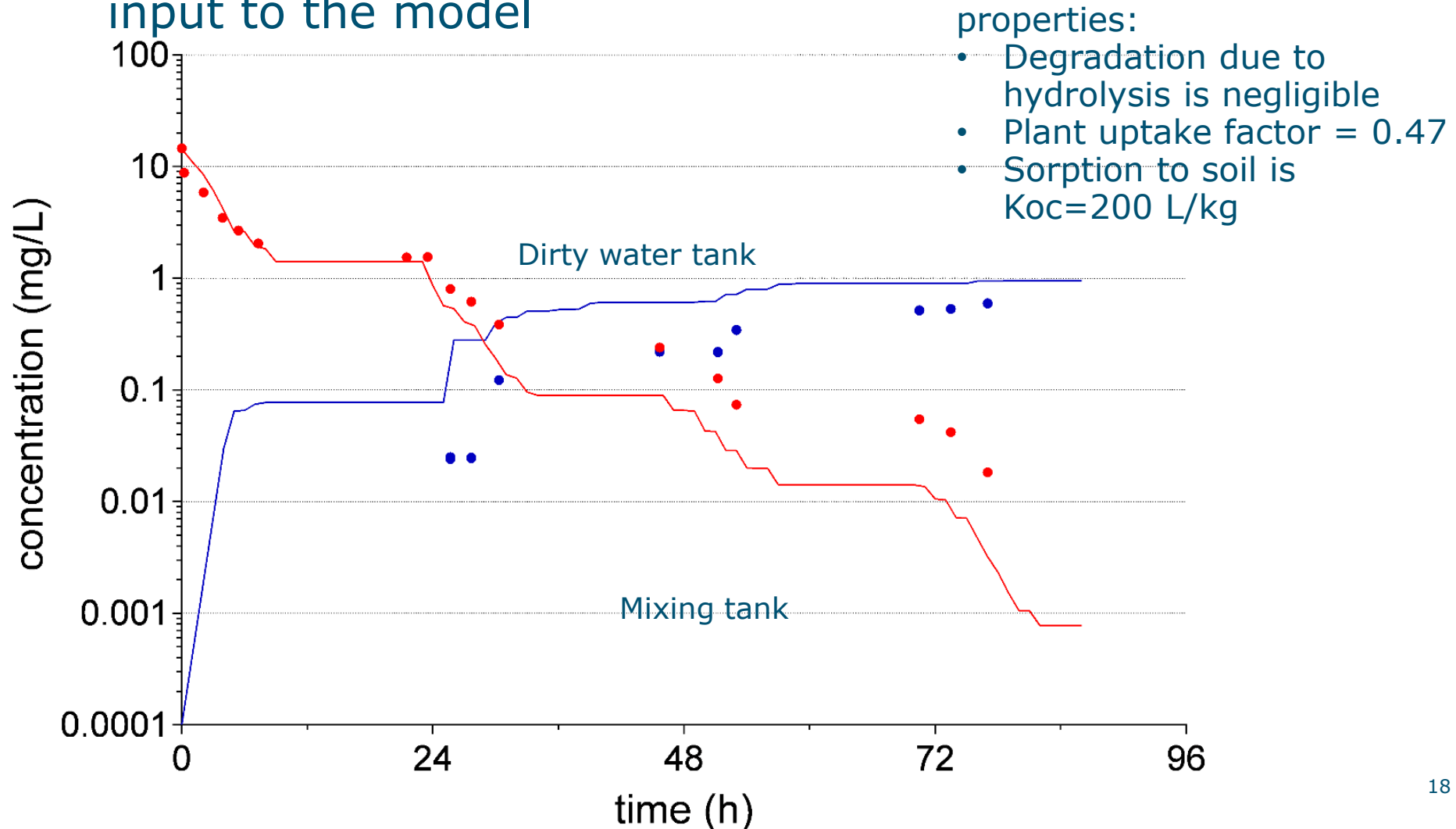
# Simulated results: pymetrozine

- Measured water flows and volumes of the tanks are input to the model



# Simulated results: imidacloprid

- Measured water flows and volumes of the tanks are input to the model



# Lessons learned from earlier experiment 2014

- Earlier experiment was done with a similar experimental set up, but with a lower frequency of measurements at the start
- No disinfection unit → recirculation of substance detected
- Poster at this conference
- Important lesson learned:
  - Effect plant uptake is significant

# Conclusions comparison measured and predicted concentrations

- Mixing tank
  - A good match on day 1,
  - After day 1: calculated concentrations decrease faster than the measurements → probably due to incomplete mixing
- Dirty water tank
  - Pymetrozine: measured and calculated concentrations are the same
  - Imidacloprid: calculated concentrations are two times higher, plant uptake may play a role
- Ozone installation causes the substance to decrease below detection level

# Outlook

- Also compare measured concentrations with concentrations based on modelled water flows instead of experimentally determined water flows
- Compare experiment and model over a larger period
- Underpinning/understanding possible incomplete mixing