

Water flows and emissions in Dutch greenhouses

Workshop on leakage of pesticides from greenhouses

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1

Wageningen Research - Greenhouse Horticulture



2

Area greenhouses (in NL)

- 9000 ha in total:
 - 50% > 5 ha, which is 15% of the number of companies
 - 40% of the number of companies <1.5 ha
 - 3500 companies
- NL: 80% soilless
- Major crops in NL:

• Tomato	1700
• Sweet pepper	1200
• Cucumber	550
• Strawberry	350
• Rose	250
• Gerbera	160
• Chrysanthemum (Soil)	450
• Potted plants	2000



Werkboek Oostland, 2020



3

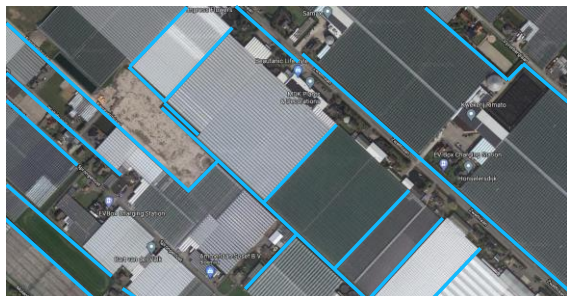
Type of greenhouses

- High tech fully climatized
- Venlo-type grh, 8 m span
- 1 or 2 screens (energy, shadow)
- Artificial lighting: high pressure sodium → LED
- Collection of rainwater
- Use of natural gas, has to go down
- Heating: 5 x 51mm pipes per 4 m
- Additional CO2: pure or from industry
- Heat water storage for day/night use
- Heat Power Contraction, depending price gas/electricity
- Geothermal power: coming up



4

Westland surface water



— Ditches, canals, surface water

5

5

Surface water



6

Cultivation systems



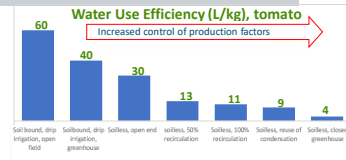
7

Water use in Dutch greenhouse production

Increased efficiency (L/m²/yr)

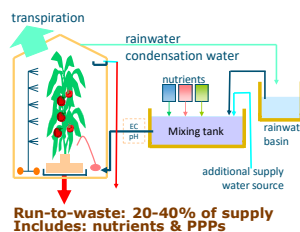
System	Reuse	Fresh water	Supply	Transpiration	Fixed in crop	Drain water	Discharge
Soil	0	1680	1680	800	40	840	840
Soilless, open	0	1200	1200	800	40	360	360
Soilless, recirculation, present situation							
Soilless, recirculation, zero emission							
Soilless, closed greenhouse, gaining transpiration water							

Supply = fresh water + reuse
Reuse = drain - discharge



8

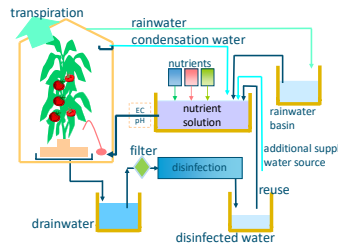
Open System



- Rainwater:
 - Good quality
 - Tanks or basins
 - <50% of water need
- Condensation water:
 - PPPs further good quality
 - 10% of water need
 - in small grh more effect of leaking to environment: more side walls
 - Side walls: not collected
- Additional water
 - Surface water
 - Quality? Diseases, nutrients, chemicals
 - Price?
- Benefits Open system:
 - No disease spread
 - No complicated fertilization
 - Cheap

9

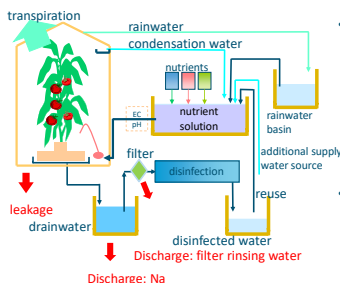
Closed system with disinfection



- Rainwater:
 - Good quality
 - 75-90% of water need
 - 1500 m³/ha
- Recirculation
 - Disinfection
- Condensation water collected
- Additional water
 - NL: reverse osmosis
- Costs:
 - Disinfection
 - Analysing nutrient composition required
- Benefits:
 - Saving water & fertilizers
 - No environmental pollution

10

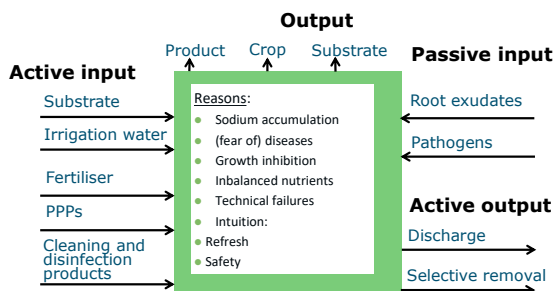
Closed system with leakage and discharge



- Leakage inside grh:
 - Connections pipework
 - Drippers drip wrong
 - Overflow troughs
 - Overflow basins
 - First drain after puncturing slabs
 - PPPs
 - About: 1.5%
- Discharge sodium
 - [Na] above threshold level → toxic
 - Composition unbalanced
 - PPPs
 - About: 0-10%;
- Filter rinsing water
 - Nutrients and PPPs
 - About: 2-4%

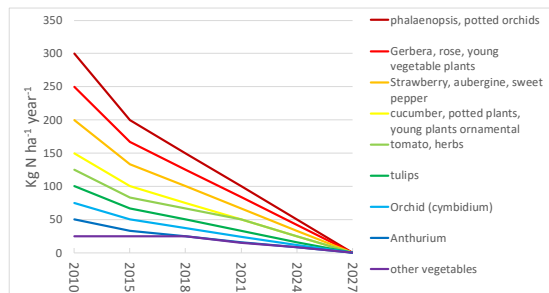
11

Water quality issues



12

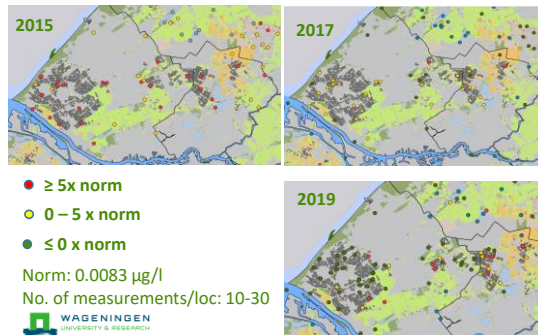
Nitrogen emission standards



13

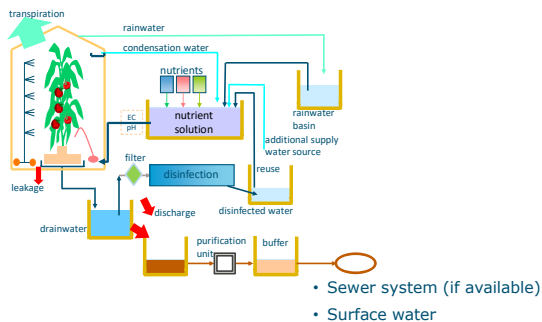
13

Imidacloprid in surface water: less exceedances



14

Purification of discharge

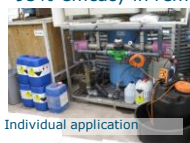


15

15

Obligatory removal of PPPs

- Approved technology on official list
- 95% efficacy in removal
- Treatment registration
- No financial compensation



16

Growers towards zero liquid emission

- Rainwater collection
- Collection of condensation water (obligatory)
- Recirculation of drain water (obligatory)
- Draining of slabs in 2 stages to avoid overflow of troughs
- Start recirculation from planting onwards
- End of cultivation strategy: emptying slabs/tanks and reducing [N], [P] in slabs
- Emission standards for nitrogen in discharge water
- Approaching zero emission in 2027
 - Funding for research to achieve this goal



17

17

Cleaning after cultivation

- End of cultivation strategy
 - Emptying slabs / storage tanks
- PPP filling station
- Cleaning:
 - Plant material: centralized composting
 - No run-off from premises:
 - paved area forbidden
 - containers for storage: leak free
 - Troughs
 - Greenhouse
 - Irrigation lines



18

18

Finishing the crop



19

Conclusions

- Need for clean surface water (EU Water Framework Directive)
- Obligatory recirculation of drain water
- Obligatory collection and use of condensation water
- Discharge mostly on sewer system
 - Nitrogen emission standards
 - Purification of discharge water for removal of PPPs
- Leakage (1.5%) is difficult to collect, as it is diffuse

→ Closed water systems towards zero emission



20

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21

Thank you for your attention!

Any questions?



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22