Root environment:
Providing food for plants and micro organisms

Directions for applications in the period 2019-2025

2019 05 24, presentation for GreenTech, Amsterdam 2019. Chris Blok and many others, Wageningen University & Research

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Providing food for plants and micro-organisms

1. Plant Fertigation and Recirculation
2. Organic fertilizers
3. Micro-organisms needed
4. Feeding micro-organisms

Soil growing

- Loss of water by evaporation
- Loss of water by leaching
  - with rain
  - with irrigation
  - with low grade fertiliser
- Over fertilisation
  - to counter rain
  - by large dressings

Irrigated and fertilised mono cultures are inherently polluting

Why irrigated and fertilised monoculture count

- Lower area use
- Less transportation
- How to deal with emission problems?

Some Advantages of Soilless Cultivation

- Growers: +15% (growth), +5/50% (crop health)
- Society: healthy safe vegetables, quality of life ornamentals
- Environment: WUE +50%, NUE +60%, 0 emission

The combination **fertigation** and **recirculation** is the key solution

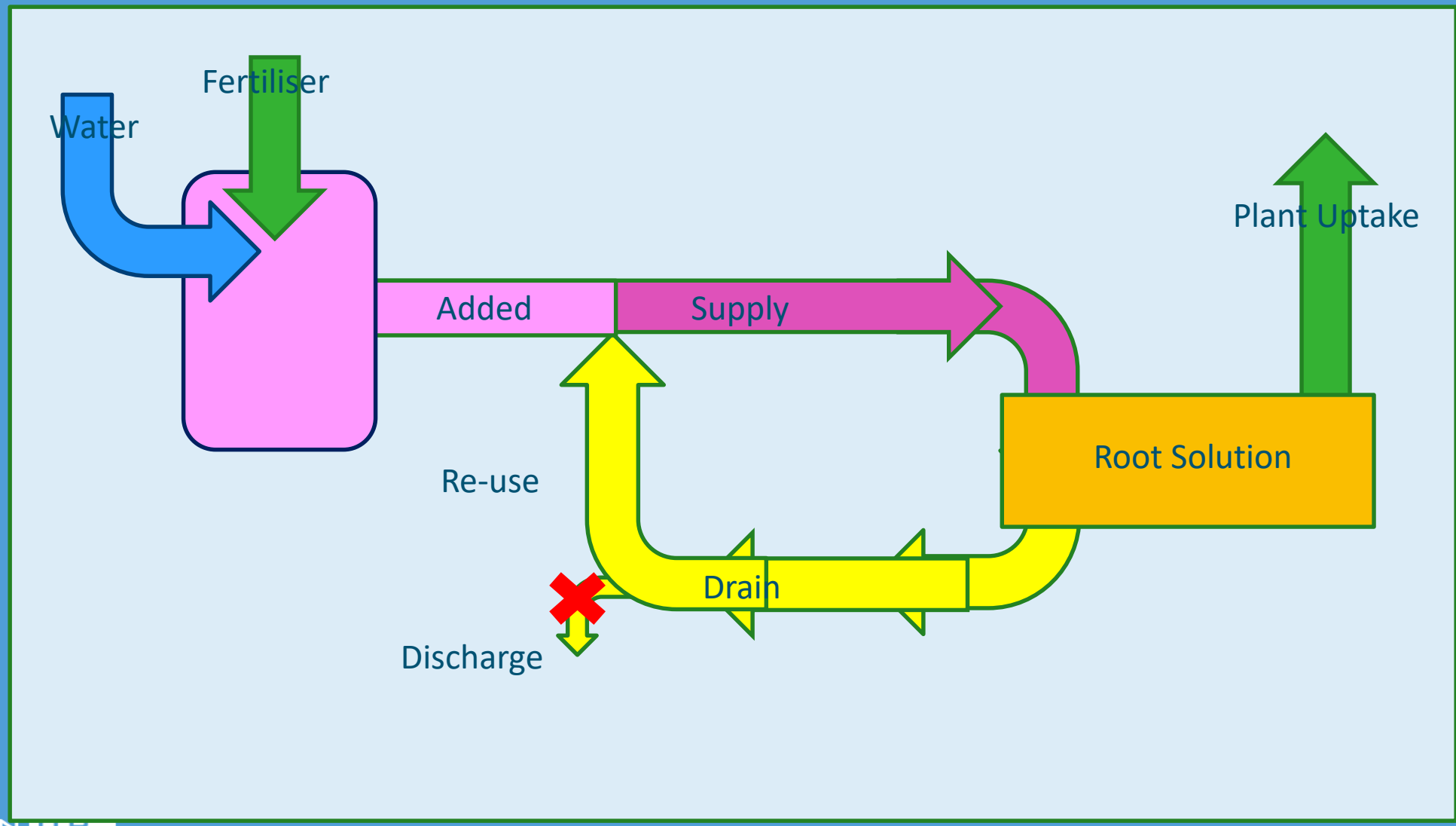
Fertigation

- Right amount, right moment
- Automated = knowledge based (can improve)
- Top down but without run off as with overhead irrigation
- Bottom up possible but requires more knowledge

Drain water re-use?

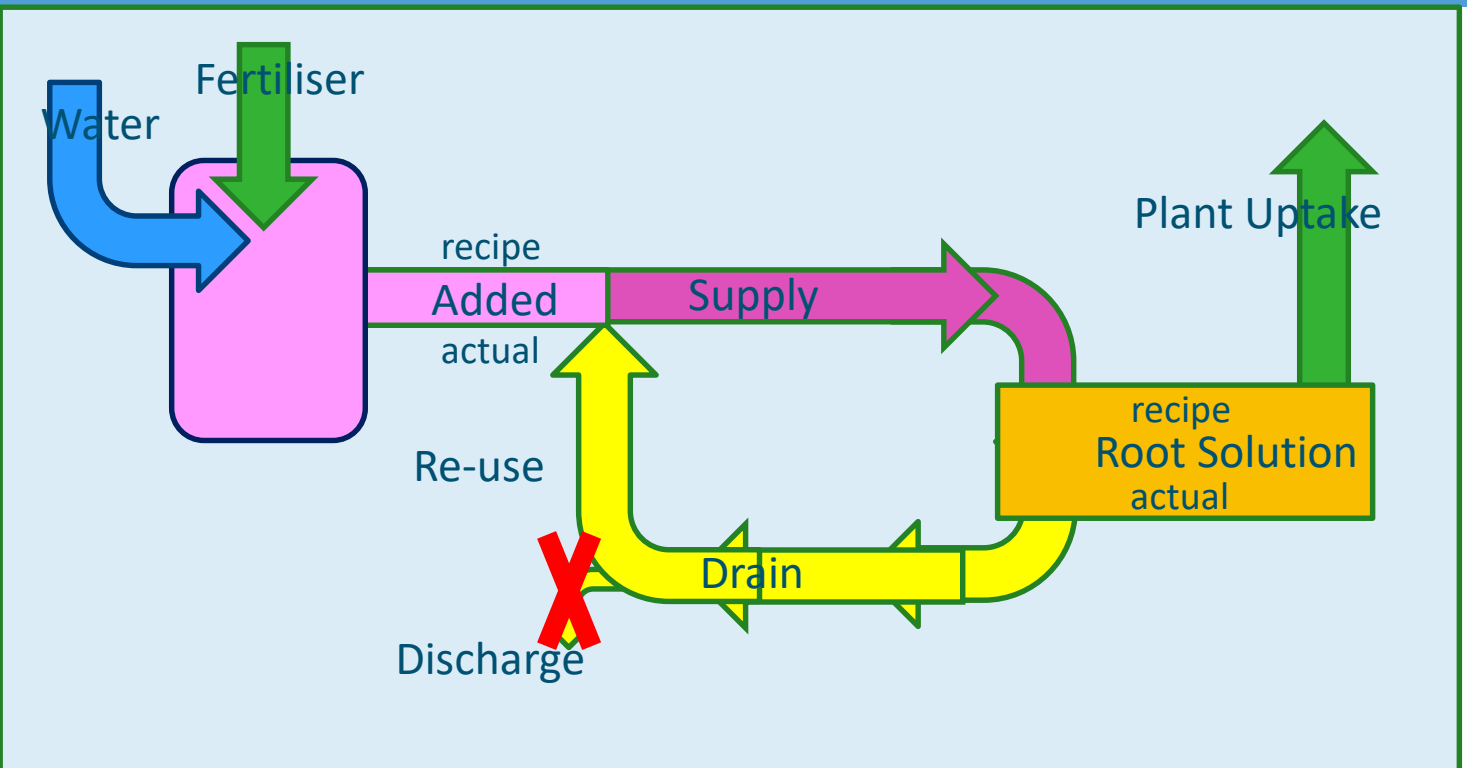
Recirculation

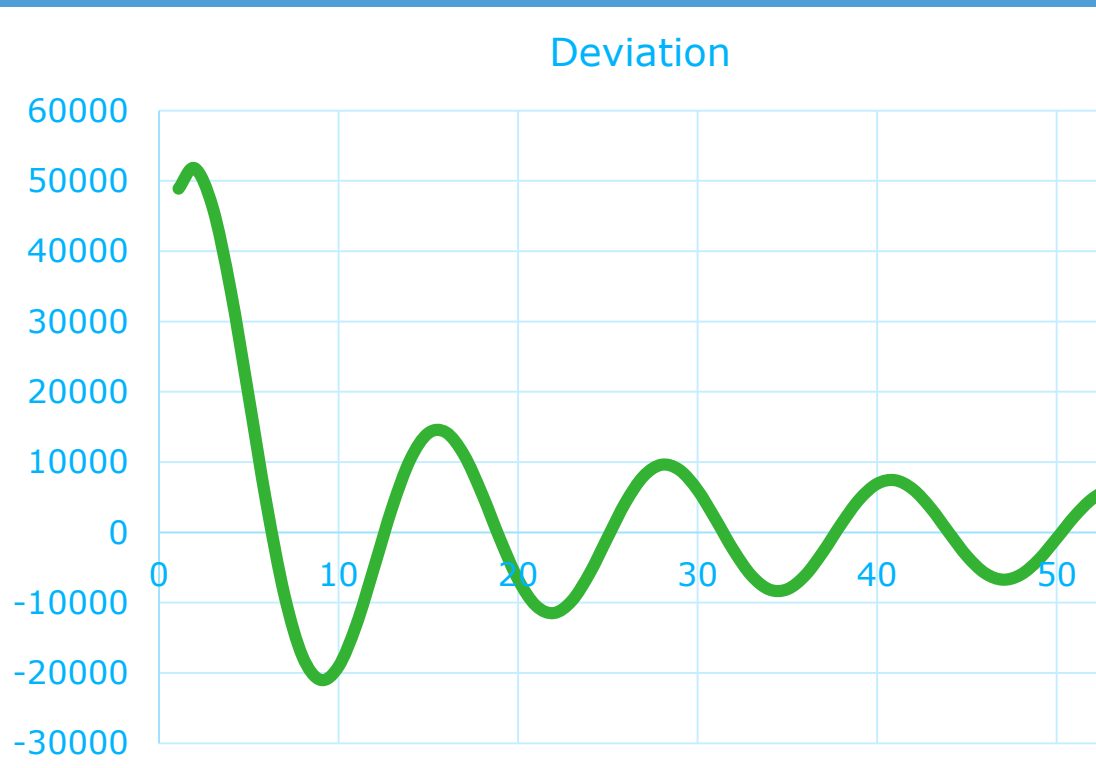
- Recipe is not Supply but it is Added
- Added is on average identical to Plant Uptake
- Figure combines water, EC and individual element cycles



The Nutrient Recommendation System

- Compare Root Solution Actual with Recipe
- Adapt Added Solution Recipe
- Inherently safe feedback for true recirculation!





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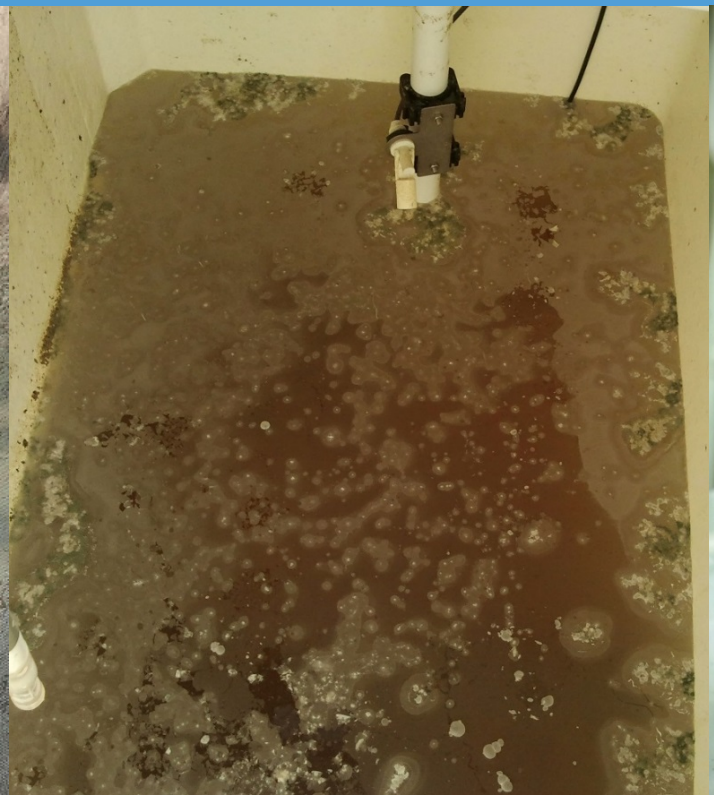
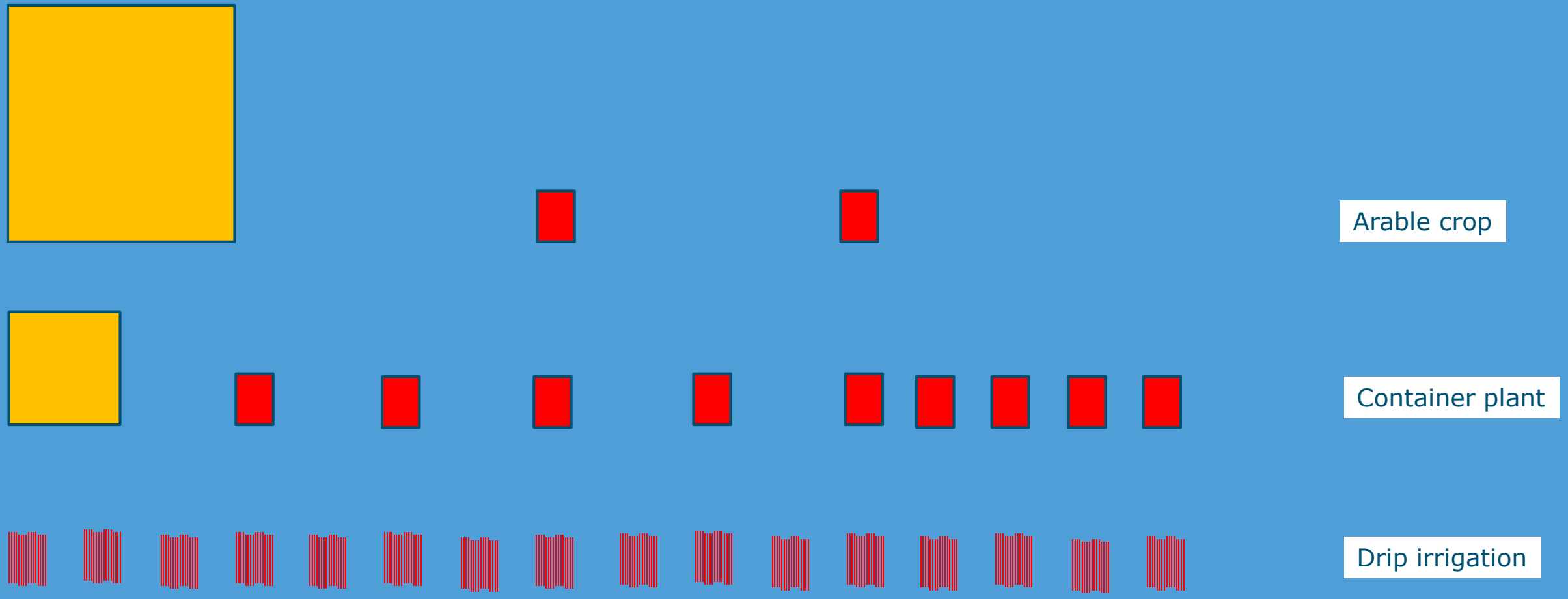
Organic Fertilisers

- Most present day fertilisers are inherently unsustainable
- Some organic Fertilisers are fully circular
- Organic fertilisers show some technical drawbacks



Base dressing, maintenance dressing

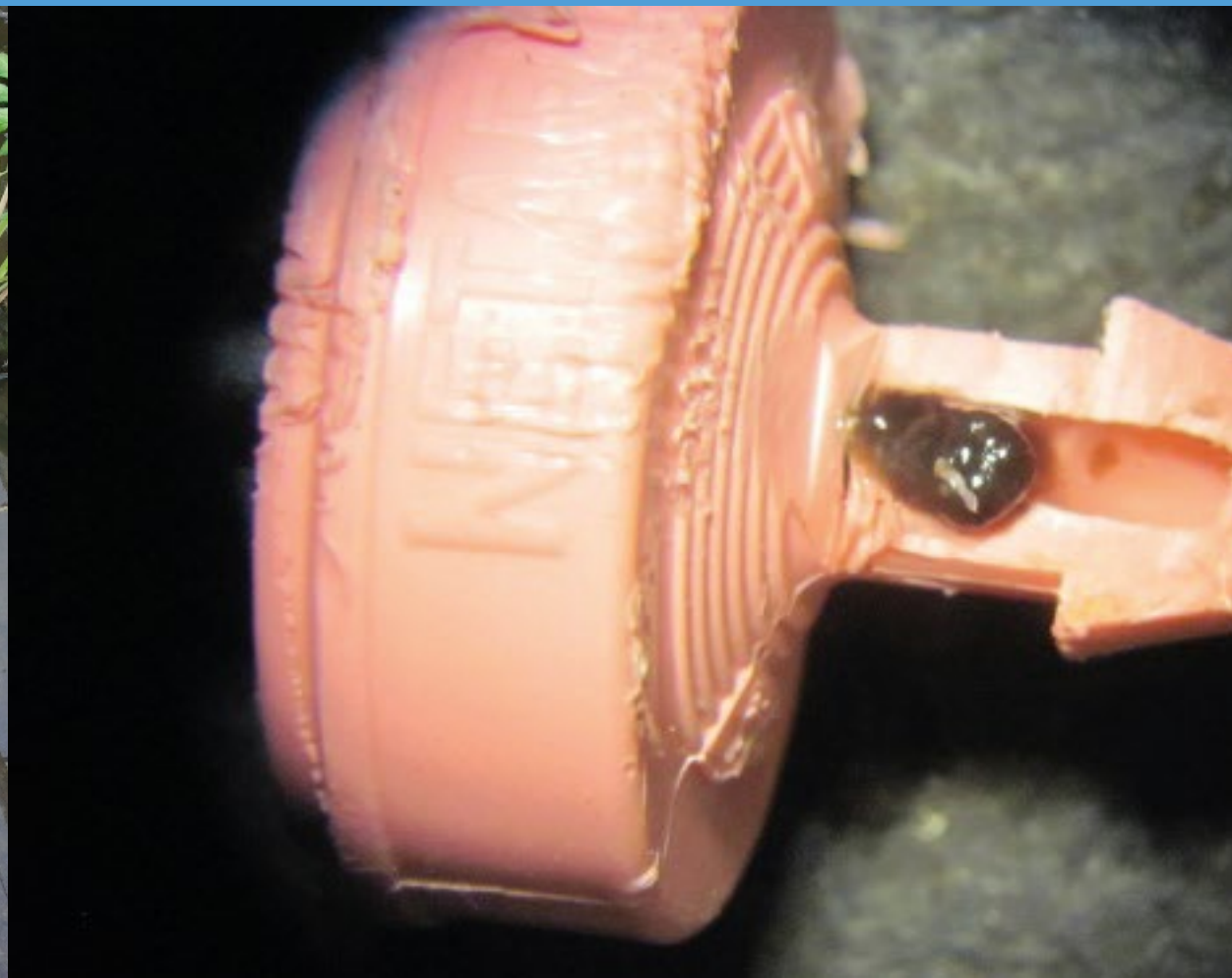


Dressing via slow release

- Larger packages required
- Cracking problems larger
- EC shock

Dressing via irrigation lines

- Preferable, but difficult



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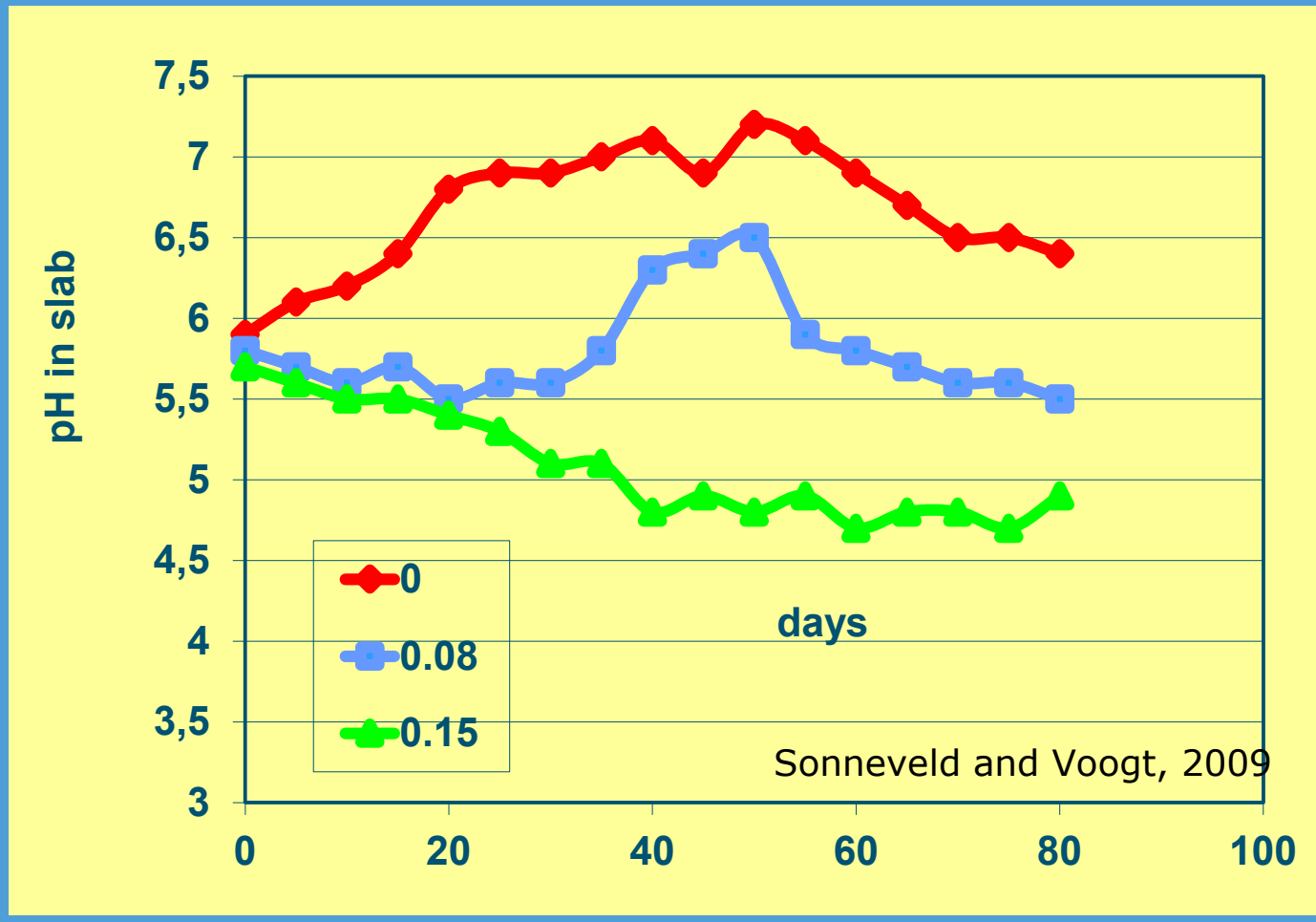
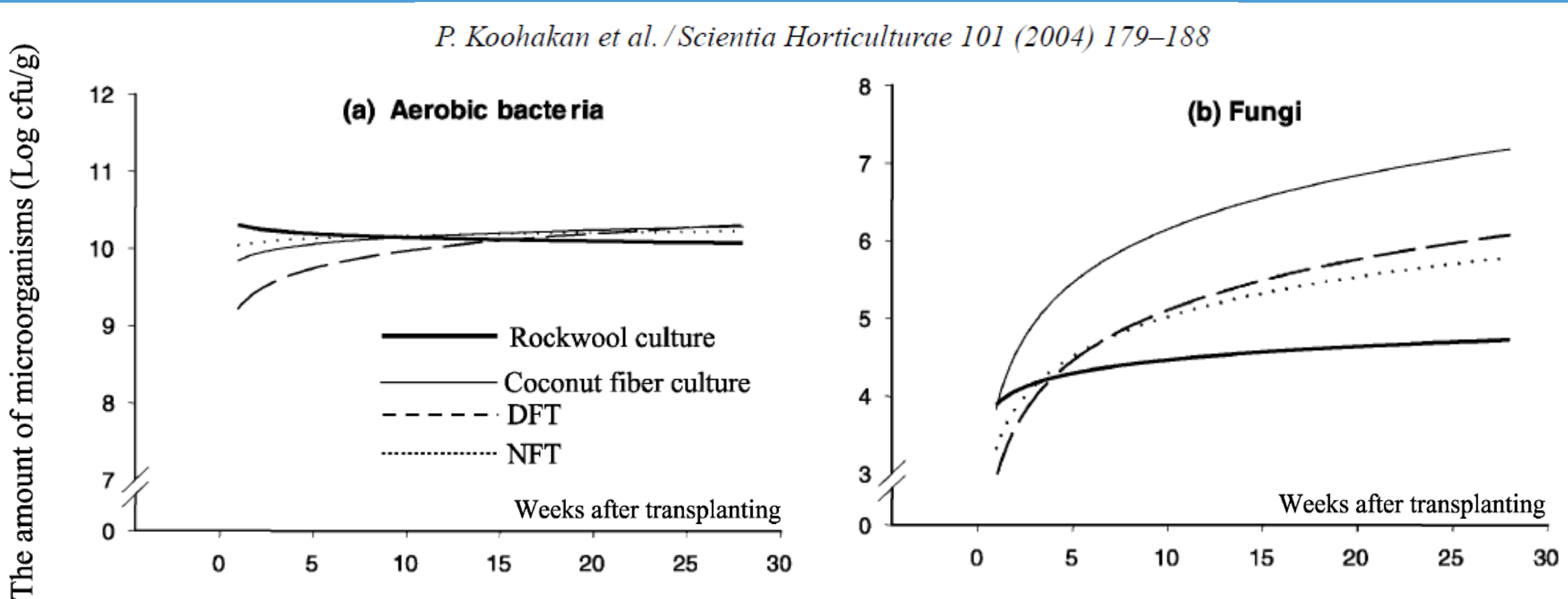
Micro organisms are needed to:

1) Breakdown the organic envelope to release the nutrients
2) Ammonium/nitrate conversion:
   - Protein/urea/amino acids to ammonium (bacteria /enzymes)
   - Ammonium to nitrite to nitrate (bacterial conversions)
   - Ammonium / nitrate ratio 2-10% to avoid pH problems
   - Nitrate is needed for fast initial growth of expanding crops



How to increase helpful m.o.

- Add the successful species OR Add a successful mix OR
- Feed the added m.o. OR Feed the substrates natural population



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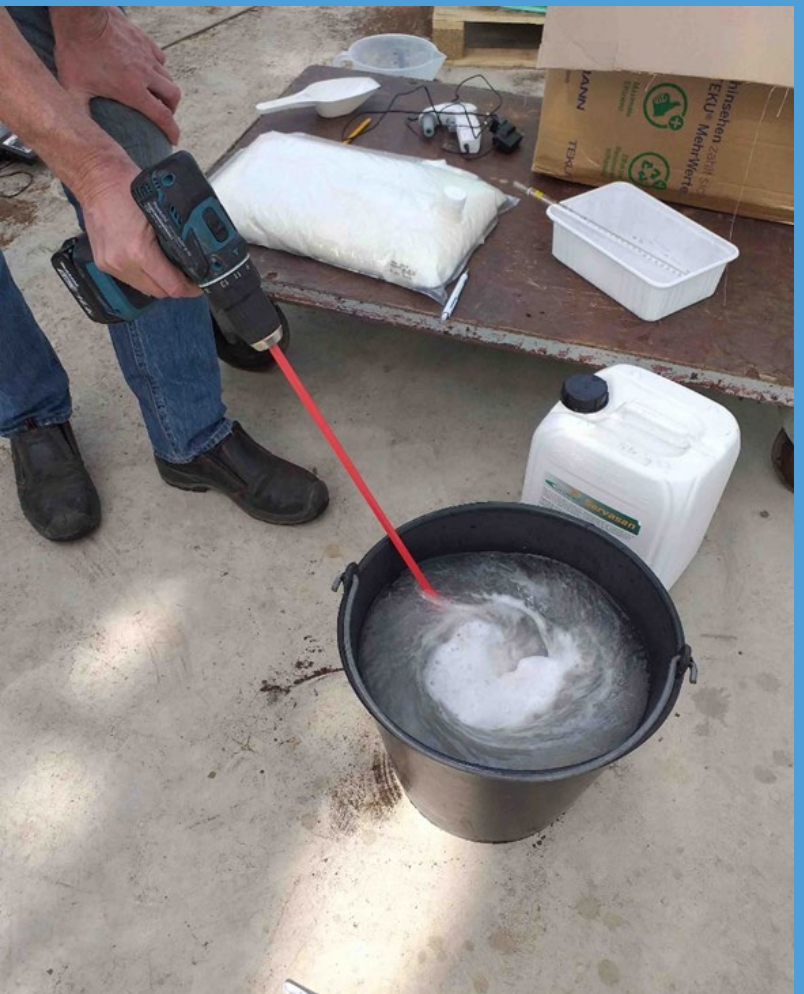
How to increase helpful m.o. numbers?

- Feed the growing medium
- Apply feed via the drip line
- Apply via propagation

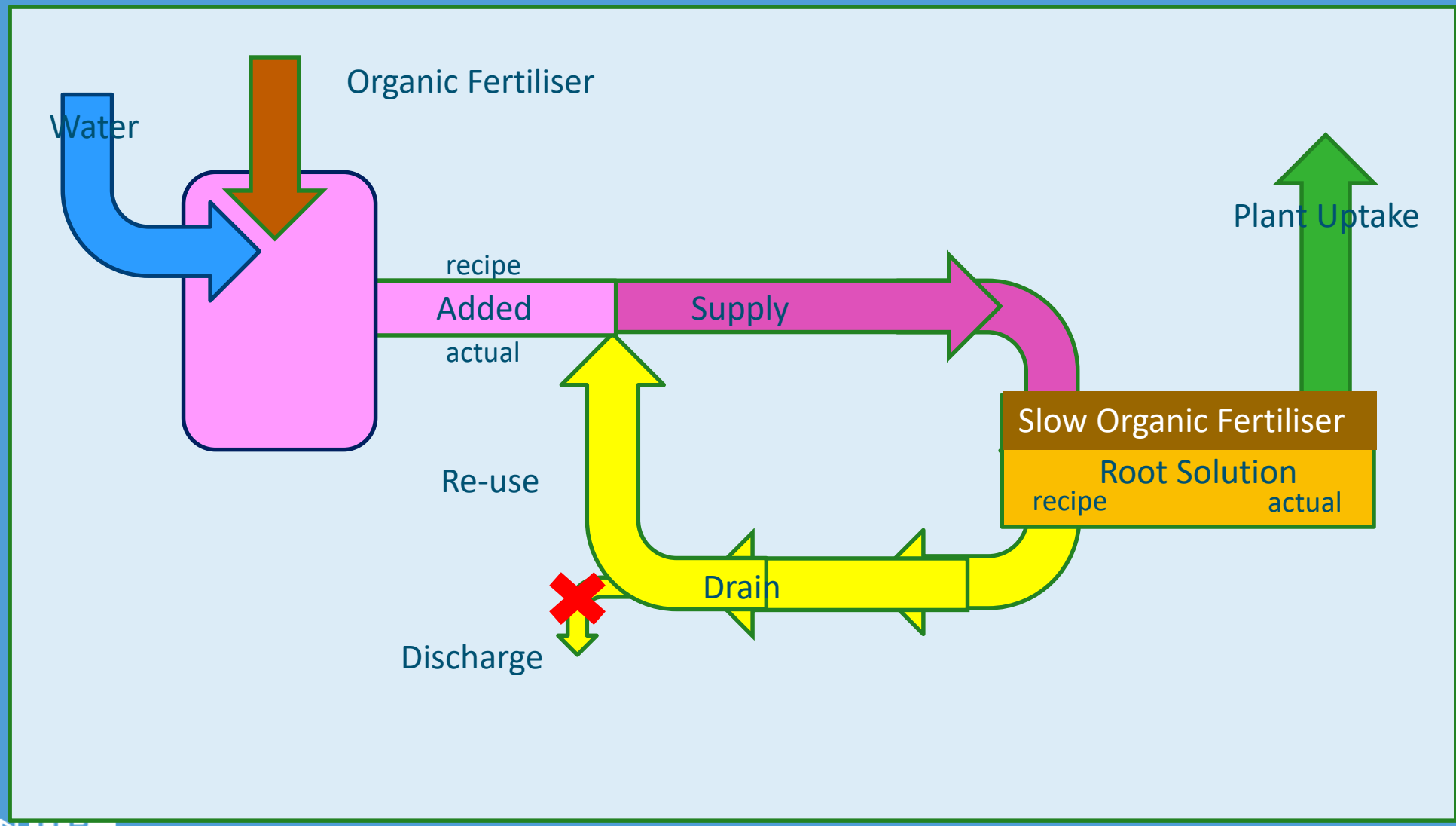
Fertigation: Dosing via drip lines

- Inherently safe feedback system required



Recirculation; recommendation for Organic Fertilisers

- Figure combines water, EC and individual element cycles
- AND carbon release, and release of Slow Organic Fertiliser
- 2 x 16 + 1 = 33 cycles



Conclusions

- Drip irrigation and recirculation are strategic advantages of soilless cultivation
- The call for organic fertilisers will increase
- Organic fertilisers can stimulate micro biological activity
- Organic fertilisers require specific microbiological activity
- This requires adapted organic fertilisers
    - Soluble for maintenance feed (drip/ebb & flow)
    - Slow release for base dressing
- Drip irrigation and recirculation are strategic advantages for organic fertilisation
- A dedicated Nutrient Recommendation System is required

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Greenhouse Horticulture

Innovations for the horticultural sector

THANKS!

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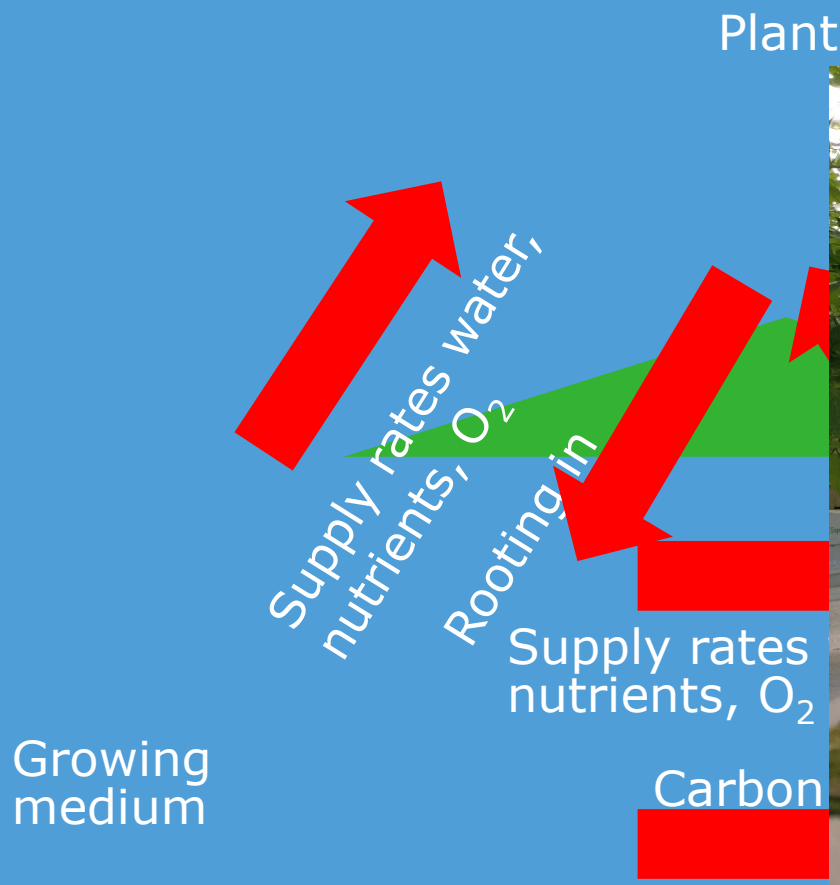
Rooting dynamics



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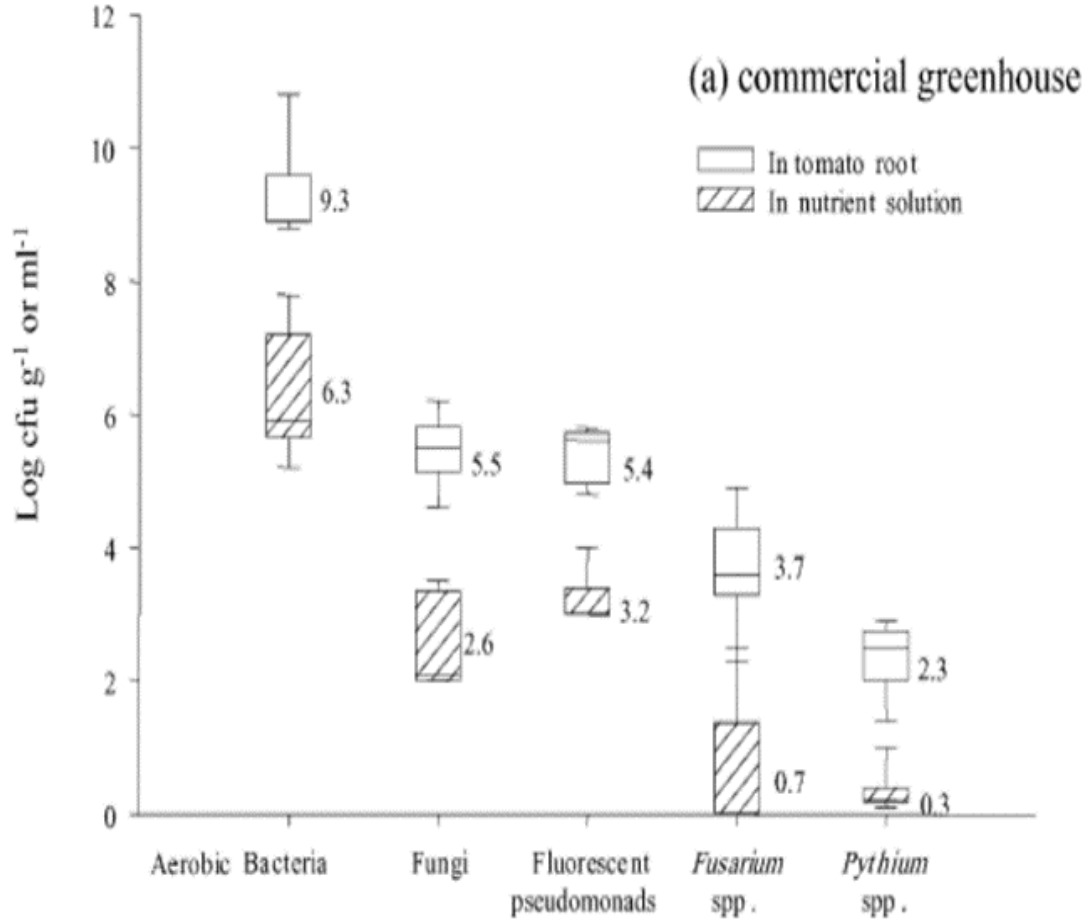

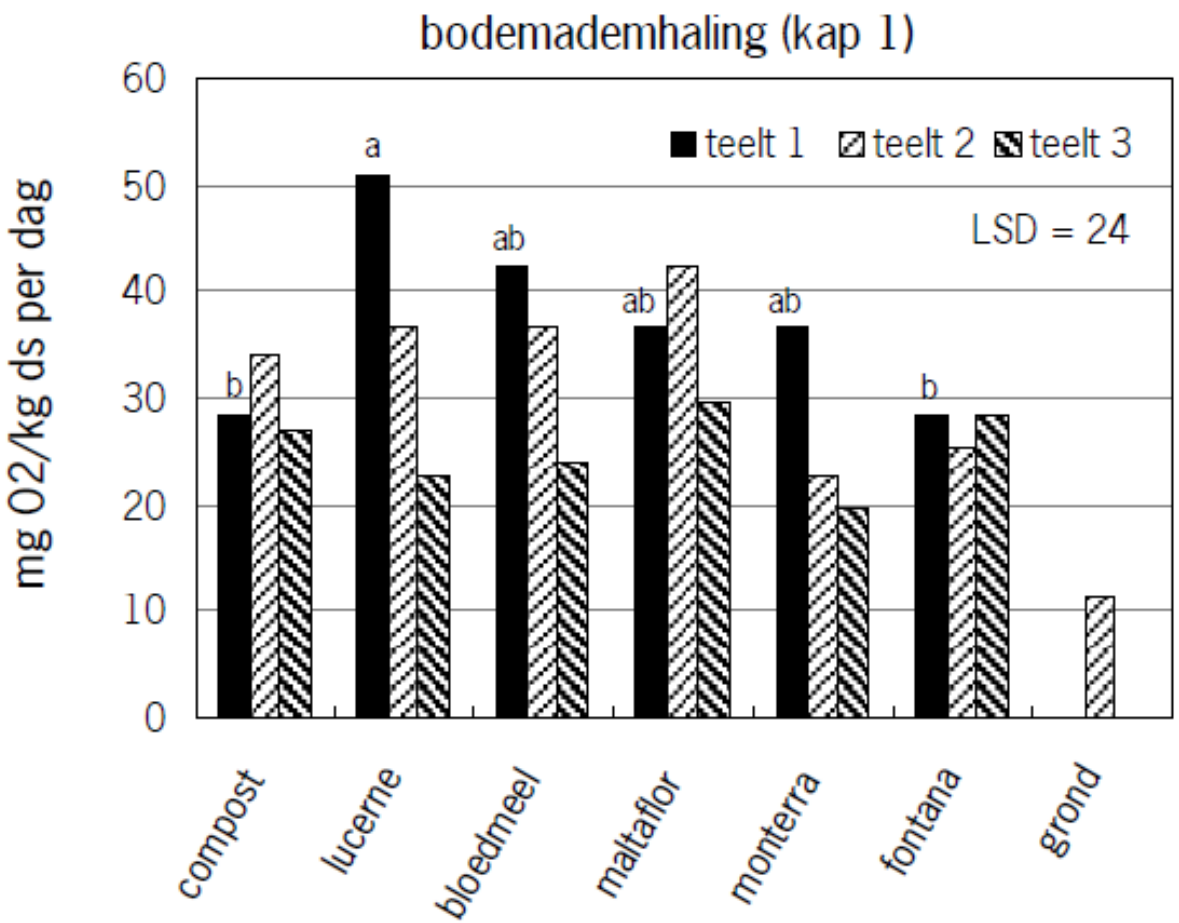

The ammonium / nitrate ratio problem

- Protein/urea/amino acids convert to ammonium (bacteria /enzymes)
- Ammonium converts to nitrite converts to nitrate (bacterial conversions)