Training Module Soilless Culture

Horticultural Skills 2014 11 07

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Wageningen UR Greenhouse Horticulture

- Staff: ca. 100 researchers
- Strategic and applied research
- Turn over: ca. M €12

Trend: export of technology and knowledge

Wageningen UR Greenhouse Horticulture

Research funding (project based):

- ✓ Private companies 35%
- ✓ Ministry of Economics (35%)
- ✓ Growers 10%
- ✓ Europ. Local, regional auth. 20%

Productschap Tuinbouw

provincie Gelderland

venlo

Ministry of Economic Affairs, Agriculture and Innovation

MKB NEDERLAND

Trend: 50% cash is matched by 50% public funds

Location: Bleiswijk

- ✓ 85 greenhouse compartments
- ✓ Laboratories crop protection, substrates and taste

Overview

- Day 1 (Historical) overview / topics / Unifarm / Water / open /recirc and disinfection
- Day 2 Substrates / systems / PCB properties / sample preparation, extracts / Analysis forms
- Day 3 Nutrients and fertilizers / Physiology and deficiency/excess / Recipes and calculations
- Day 4 Sampling substrates and drainwater, adaptation during cropping, EC, pH, O2, T
- Day 5 Excursion substrate production; Tomato on stonewool; rose on Coir; Lettuce in NFT/DFT

Soilless Culture

- "...rooting media other than soil in situ": Steiner
  - Including solid rooting media
  - Including water cultures
- NB: Internationally "hydroponics" include solid media

Gerbera on coir, Brazil

Lettuce on running water (NFT), Spain

Pepper on rice husks, Indonesia

Advantages of Soilless Culture

1.Yield

- Disease control
  - Nematodes, Agrobacterium, Phytophtora, Fusarium, etc
- Nutrient control
- Water content control
- Standardization = learning

2. Environmental

- Re-use of W /N/ P =Water/Nitrate/Phosphorous
- Energy efficient
- Area efficient
- Land efficient (slope, salinity)

Best possible LCA (life cycle analysis)!

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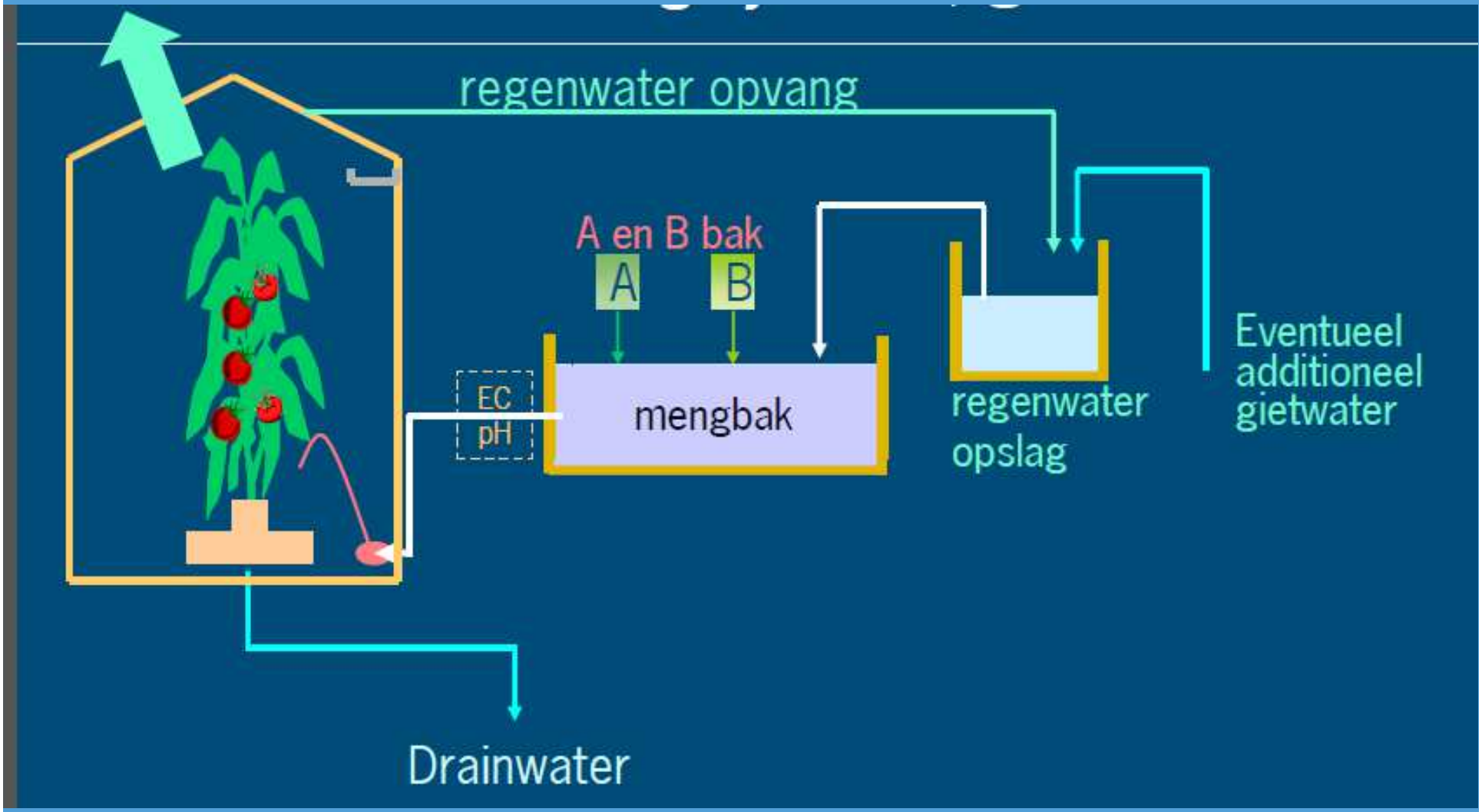
Recirculation versus free draniage

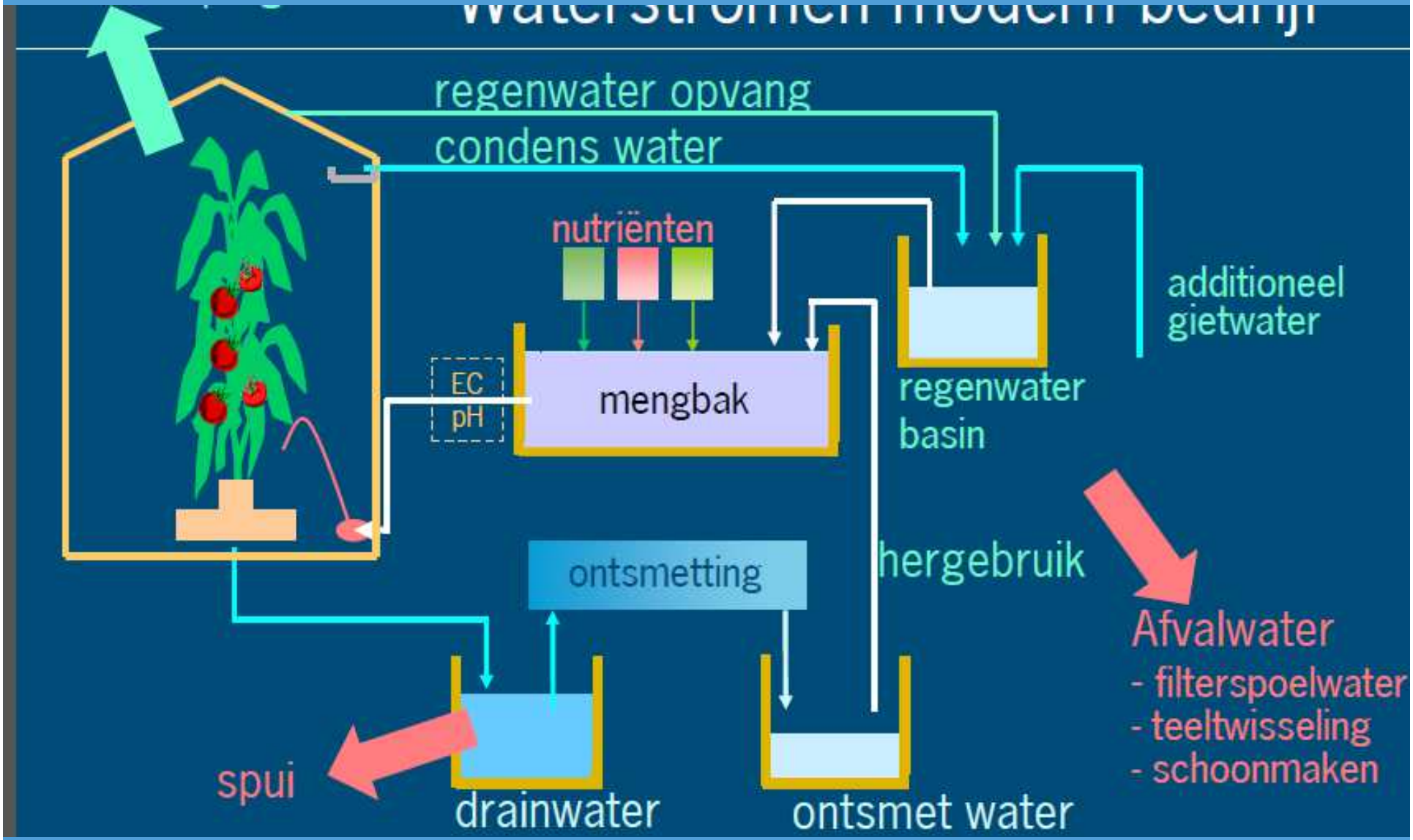
Roses, coir, Uganda

Ornamentals, peat, United Kingdom

Free drainage

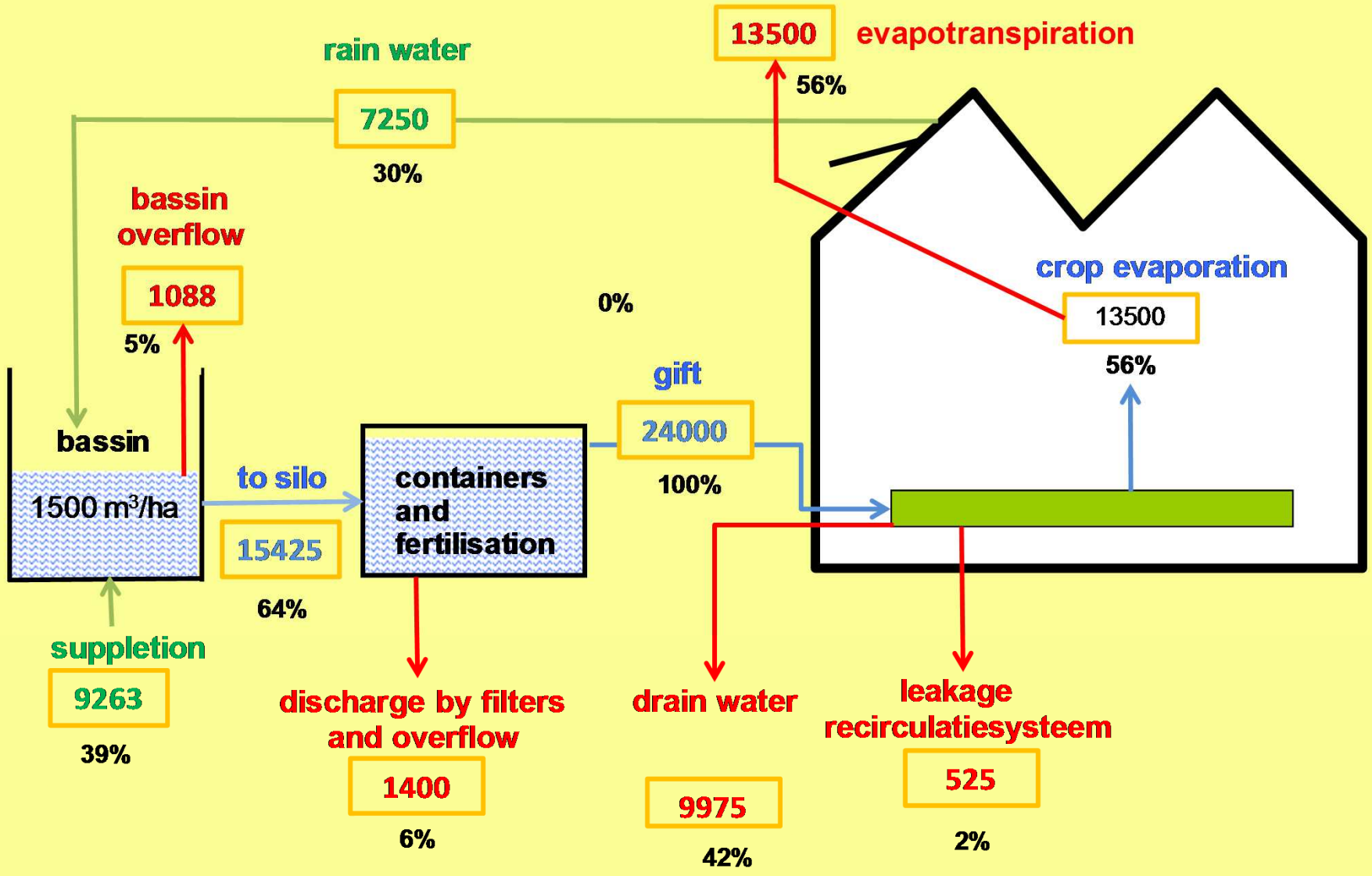


Recirculating System



Water balances and emission (m^3/ha/jaar)

including percentage of plant supply for Ethiopian Rose



System components

- Water source
- Storage water = Basin (basin bag)
- Nutrients (purer)
- Nutrient dosing
- Irrigation distribution
- Rooting medium
- Plant support
- Drain collection
- Drain storage
- Disinfection
- Storage disinfected solution
- Drain measuring
- Calculating adaption
- Drain mixing unit
- EC / pH control (raw water, irrigation solution, drain solution)

Rooting Media

- Organic; peat, coir, wood, compost, sfagnum
- Inorganic; rockwool, perlite, pouzolane, vermiculite
- Synthetic; oasis (phenol), hypol (poly uretane), super adsorbing polymers (SAP; polyacrylate), styropor (poly lactic acid).

ROOTING MEDIA

- Organic; peat, coir, wood fibre, wood chips, bark

ROOTING MEDIA 2/5

- Mineral; rockwool, perlite, vermiculite, clay pellets

ROOTING MEDIA

- Synthetic; foams, fibers, Super Adsorbing Polymers

ROOTING MEDIA

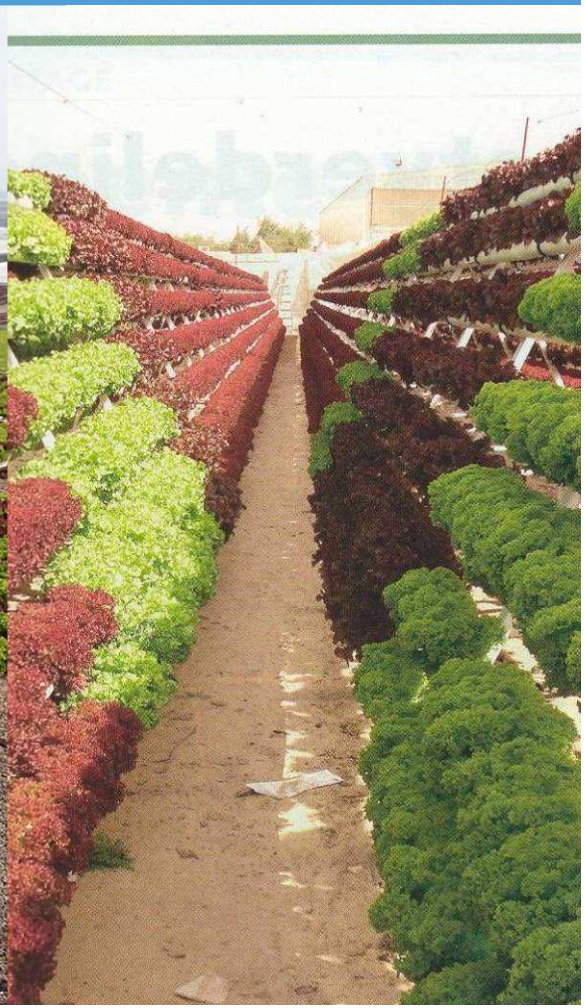
- Bio Based Rest Products; compost, straws, husks

Water Based Growing systems

- NFT (gullies)
- DFT (bassins)
- Aeroponics (mist)
- Sub irrigation?

ROOTING SYSTEMS NFT

Trend: Lettuce on water world wide



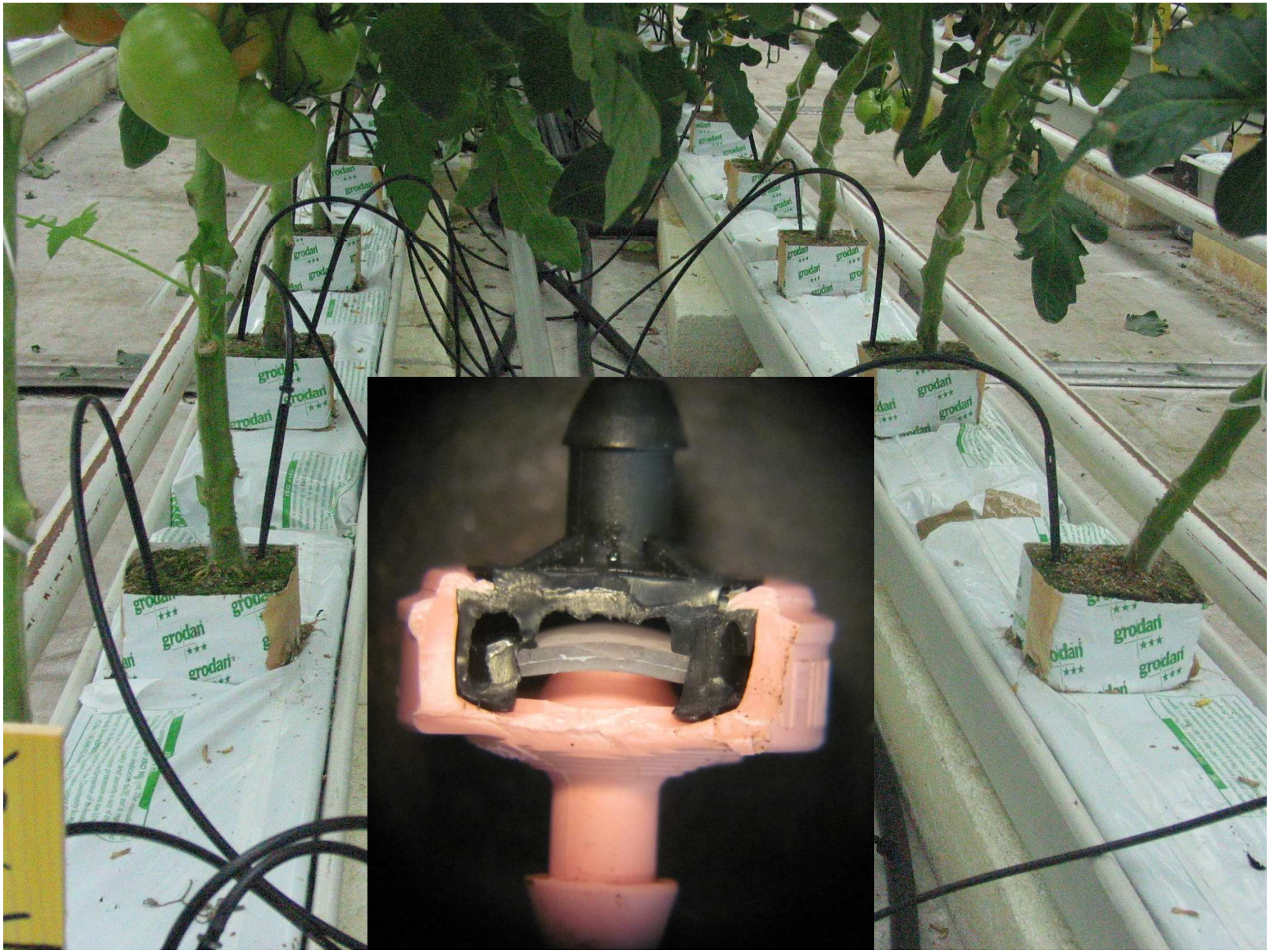
ROOTING SYSTEMS DFT

Leek and lettuce, NB propagation plugs still present

ROOTING SYSTEMS AEROPONICS (MIST)

ROOTING SYSTEMS SUB IRRIGATION

ROOTING SYSTEMS OVERHEAD IRRIGATION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Physical aspects of growing media

1. Solids
    1. Density
    2. Penetrability
2. Water
    1. Water retention curve
    2. Water uptake rate
3. Air (oxygen)
    1. Air (oxygen) content
    2. Air (oxygen) transport rate

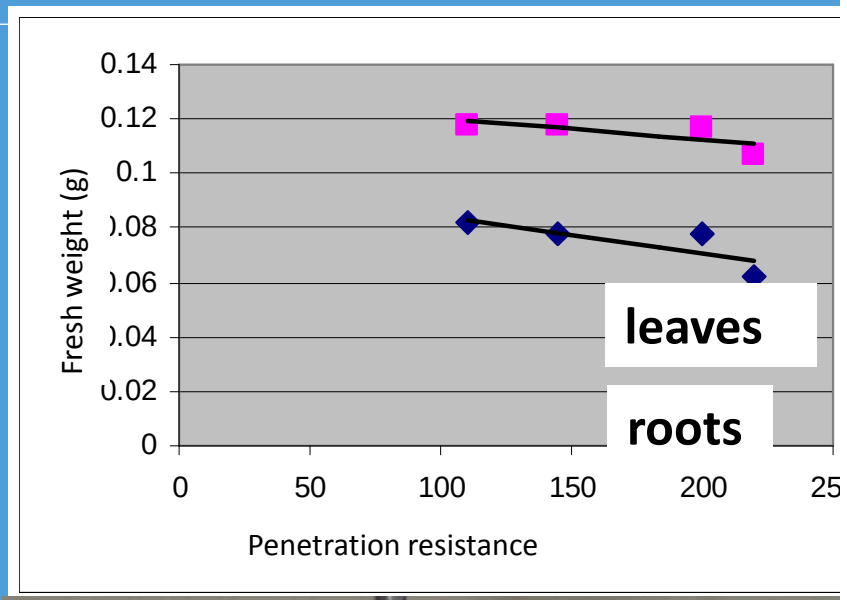
1 Solids: Bulk density

- Bulk density
- Density profile
- Layering
- Crusting

Sample	Bulk Density in $kg.m^{-3}$
Expanded clay 0-4 mm	650
Peat	350
Rockwool	70

Kipp e.a., 2000

1 Solids: penetrability (resistance to rooting)



Gaag, van der, and Wever, 2004

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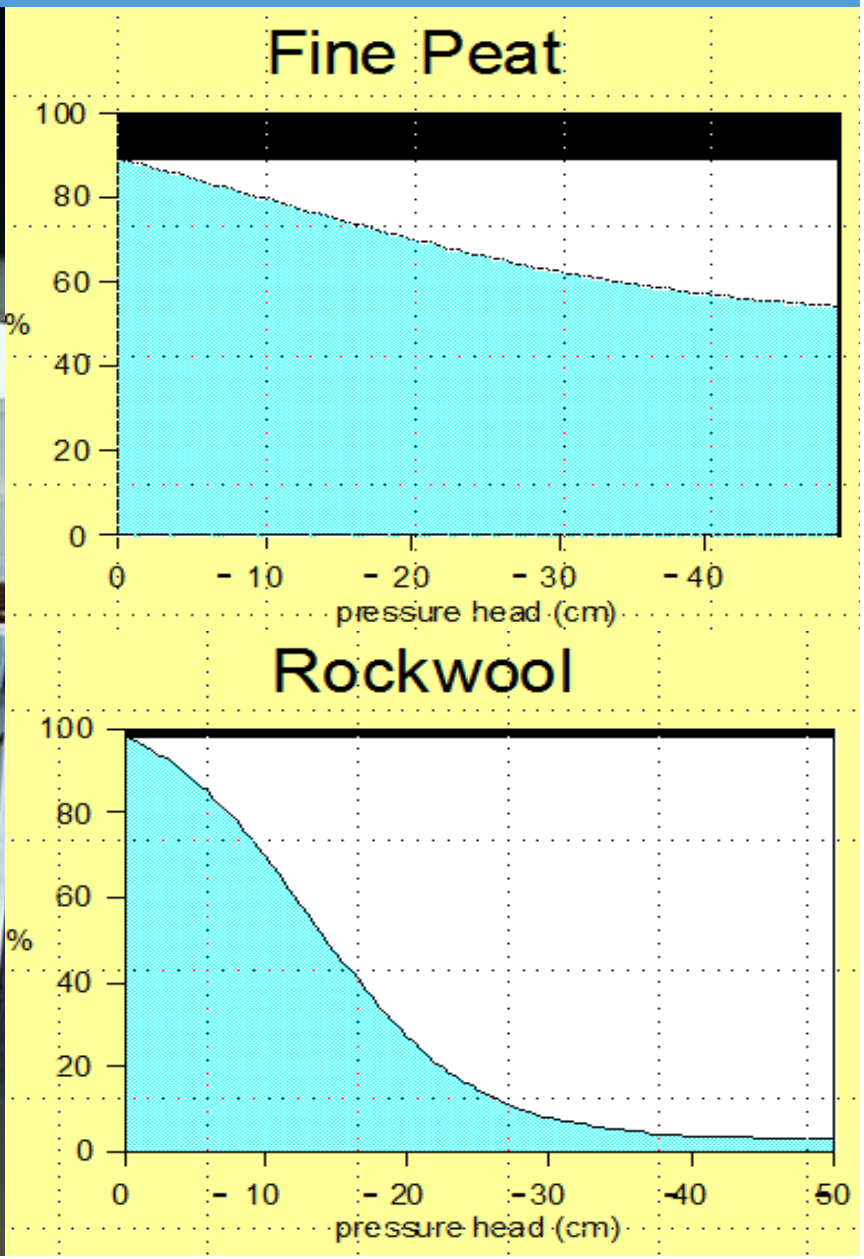
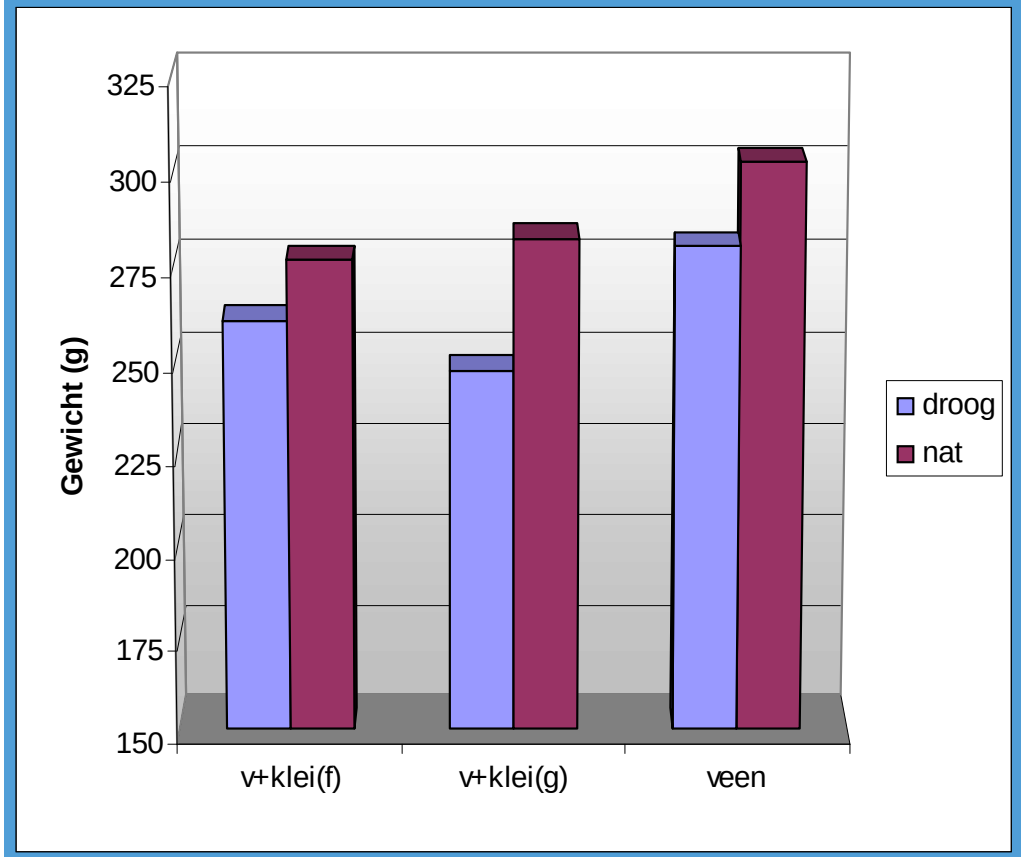
Other: PSD

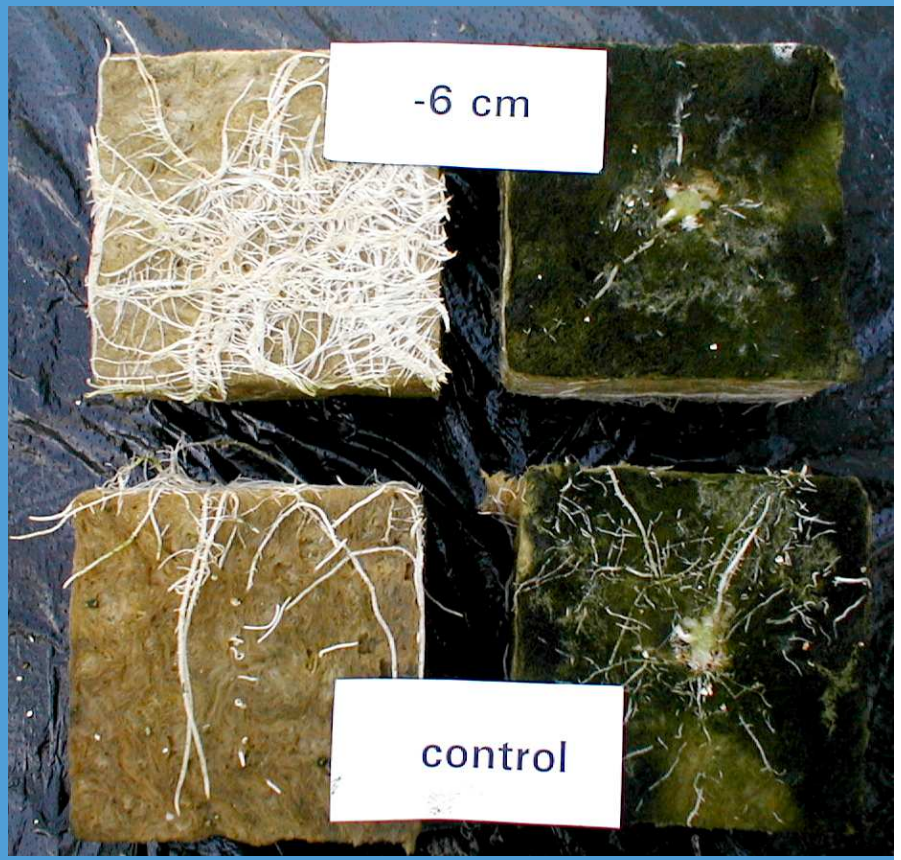
- PARTICLE SIZE DISTRIBUTION

2 Water: Water retention curve



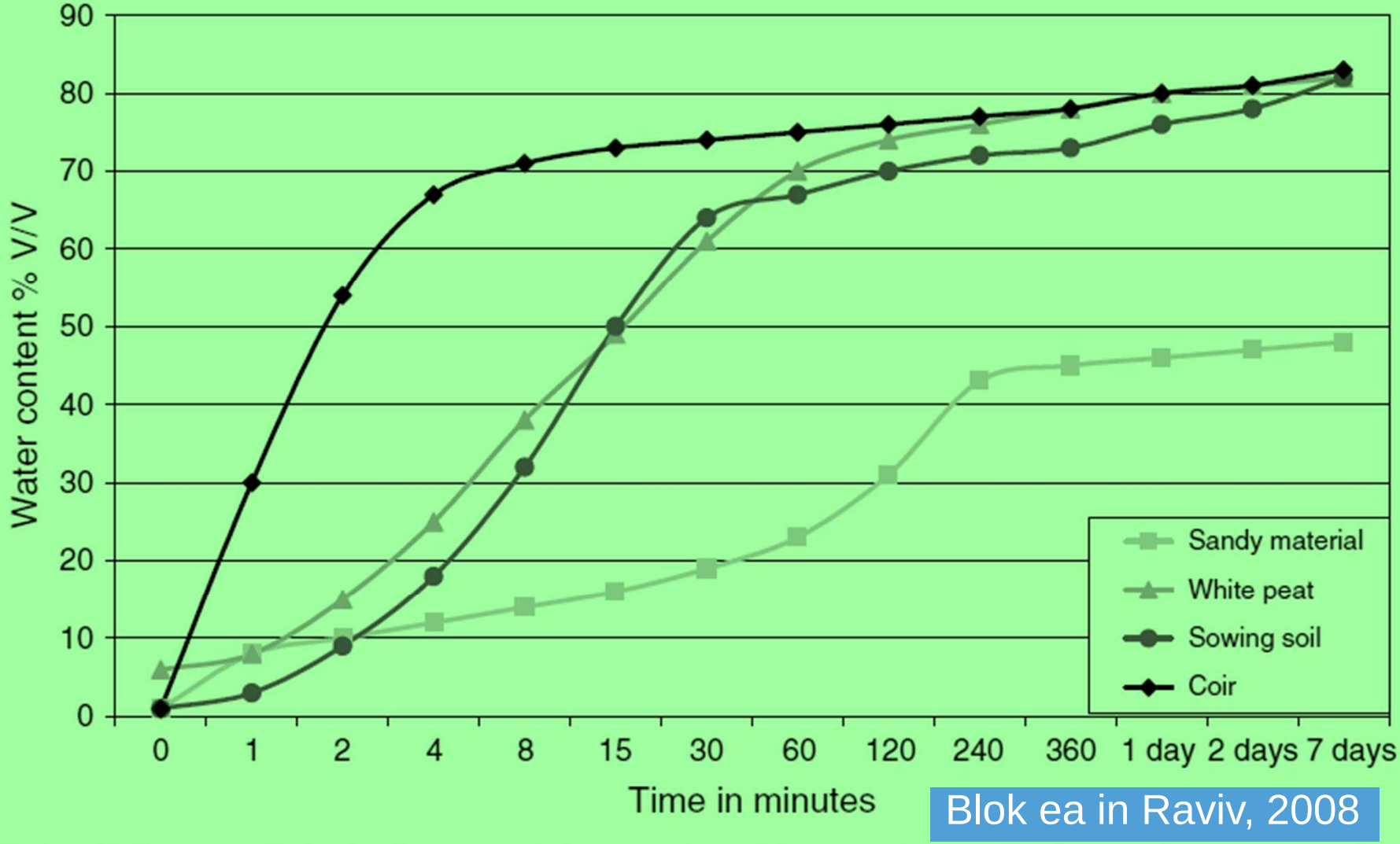
2 Water: Growth effects





Wever, 2004

Water: Rewettability



Blok ea in Raviv, 2008

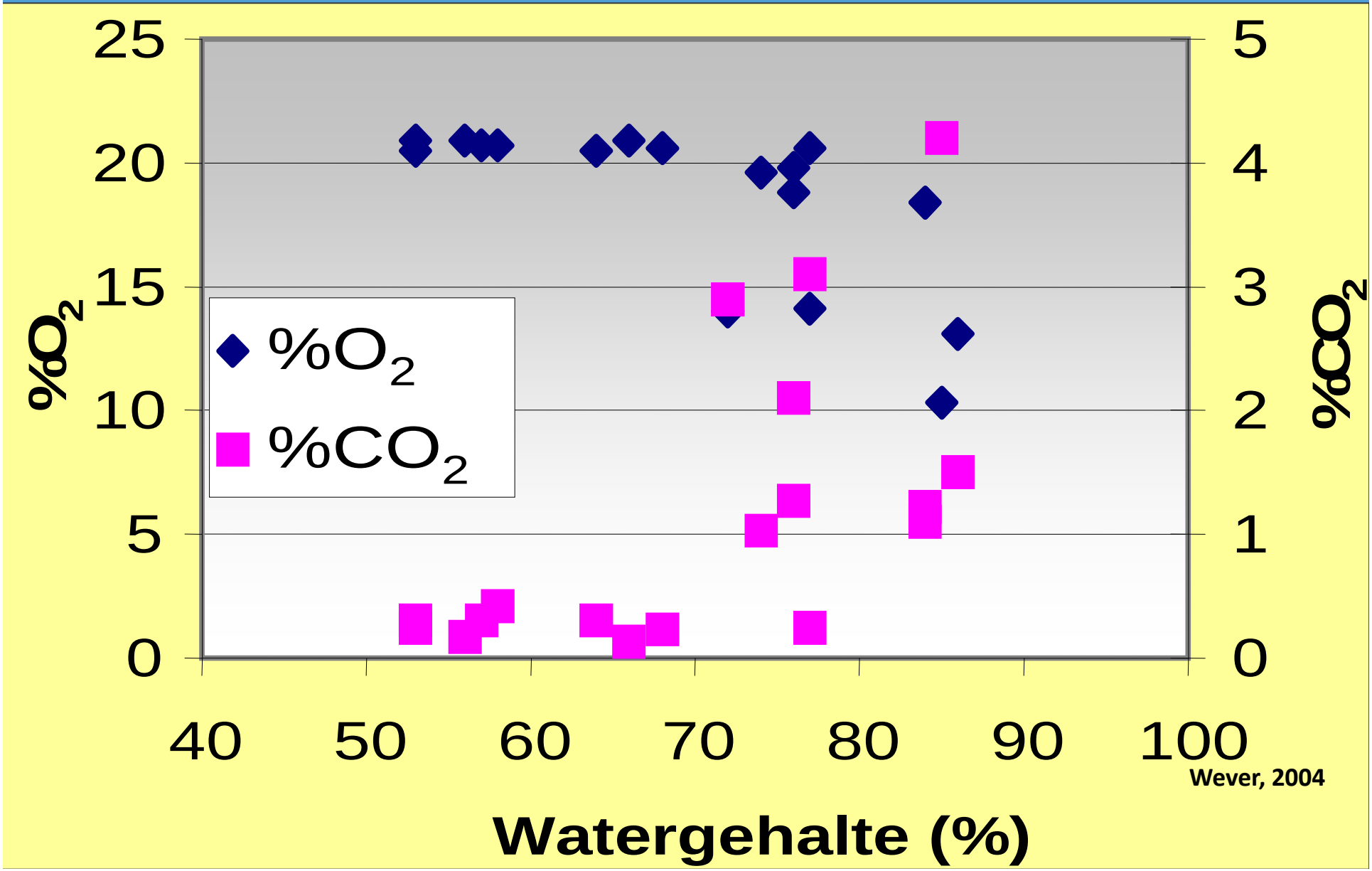
FIGURE 7.3 Rehydration rate of dry samples of four rooting media from a free water surface.

Air: Total Pore Space, TPS

Volume%	Total Pore Space
Glaswool	98
Rockwool	97
Perlite	96
Poly-urethane	95
Coir	95
Peat	91
Pumice	83
Expanded clay	76

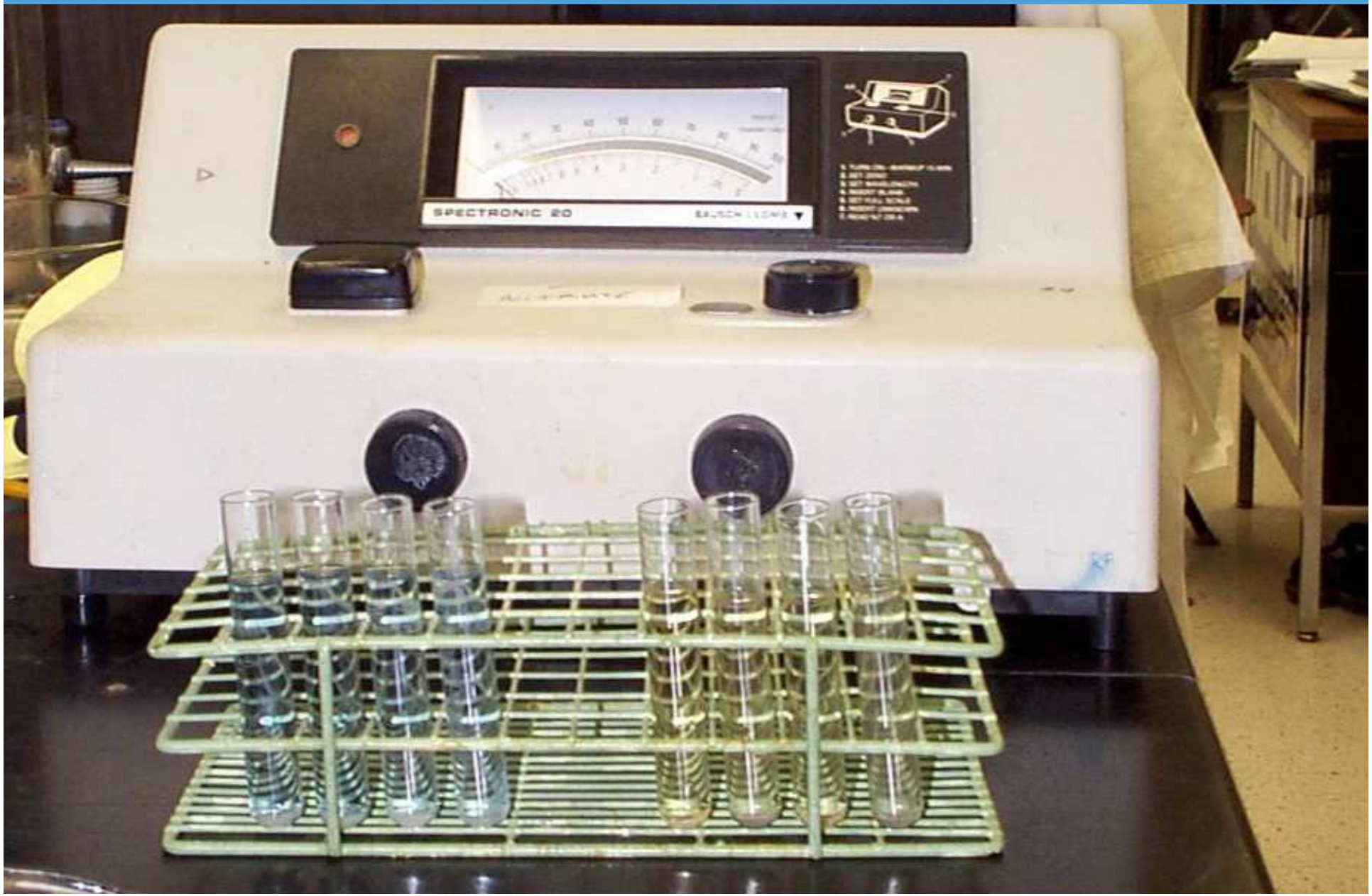
Kipp e.a., 2000

Air: oxygen diffusion

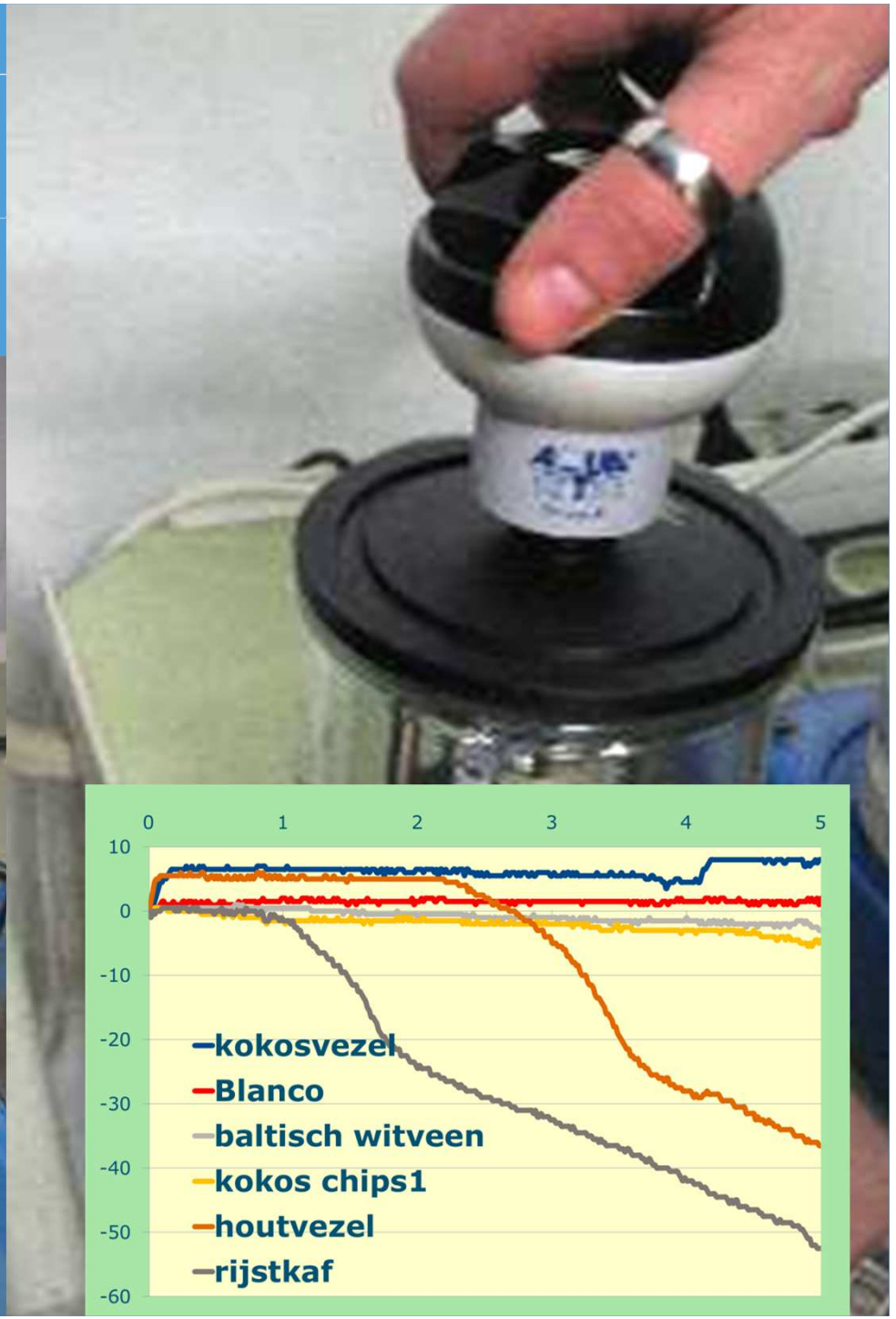


PHYTOTOXICITY

Chemical Analysis

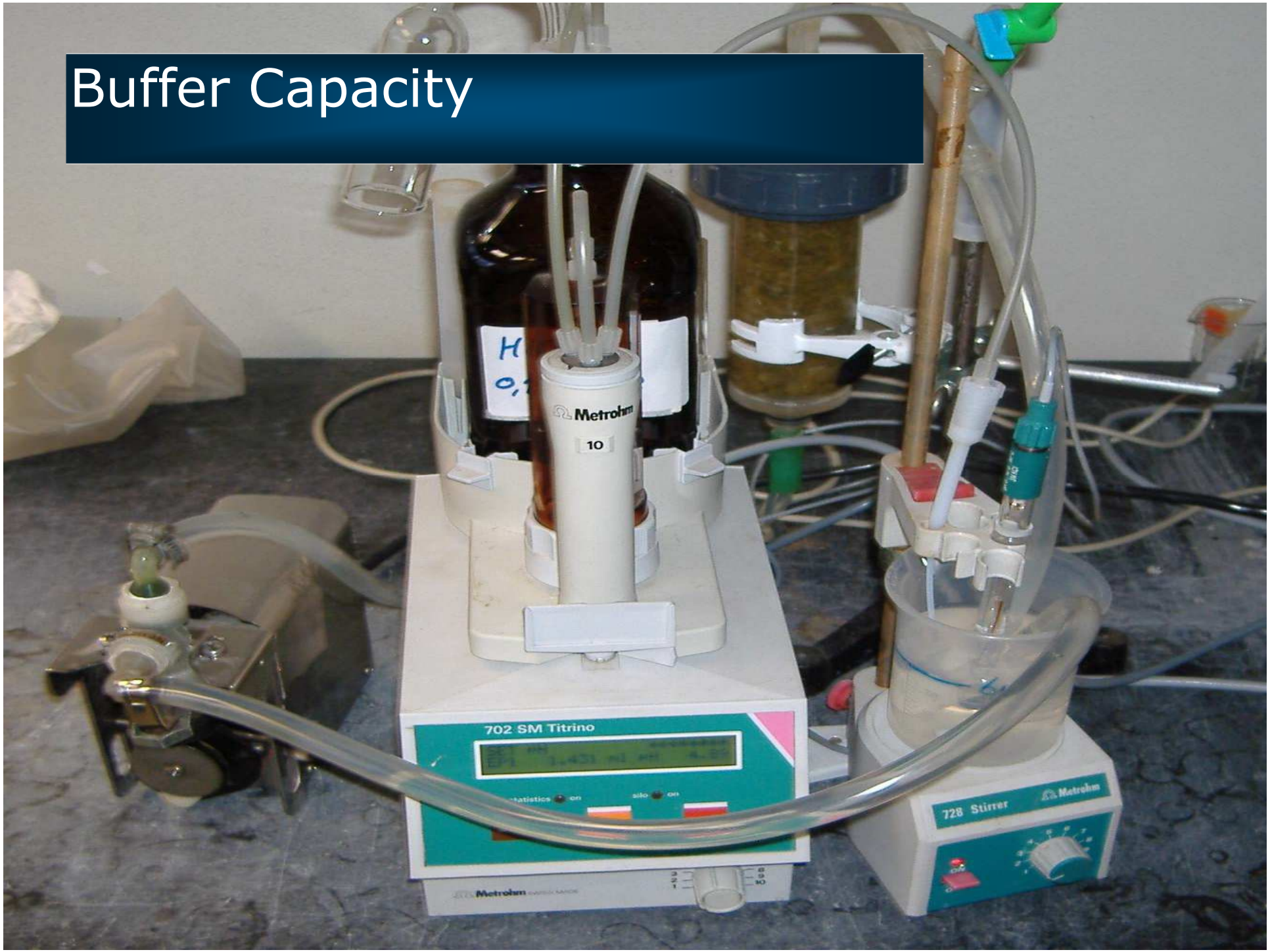


DEGRADABILITY



SHRINKAGE

Buffer Capacity



DEGRADABILITY

DEGRADABILITY


DEGRADABILITY

DEGRADABILITY

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Innovations for the horticultural sector

THANKS!

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LOCAL CONTEXT

Not high tech vs low tech but develop within the local context

LOCAL CONTEXT

Not open air vs protected but develop within the local context

LOCAL CONTEXT

Not water vs substrate but development within the local context

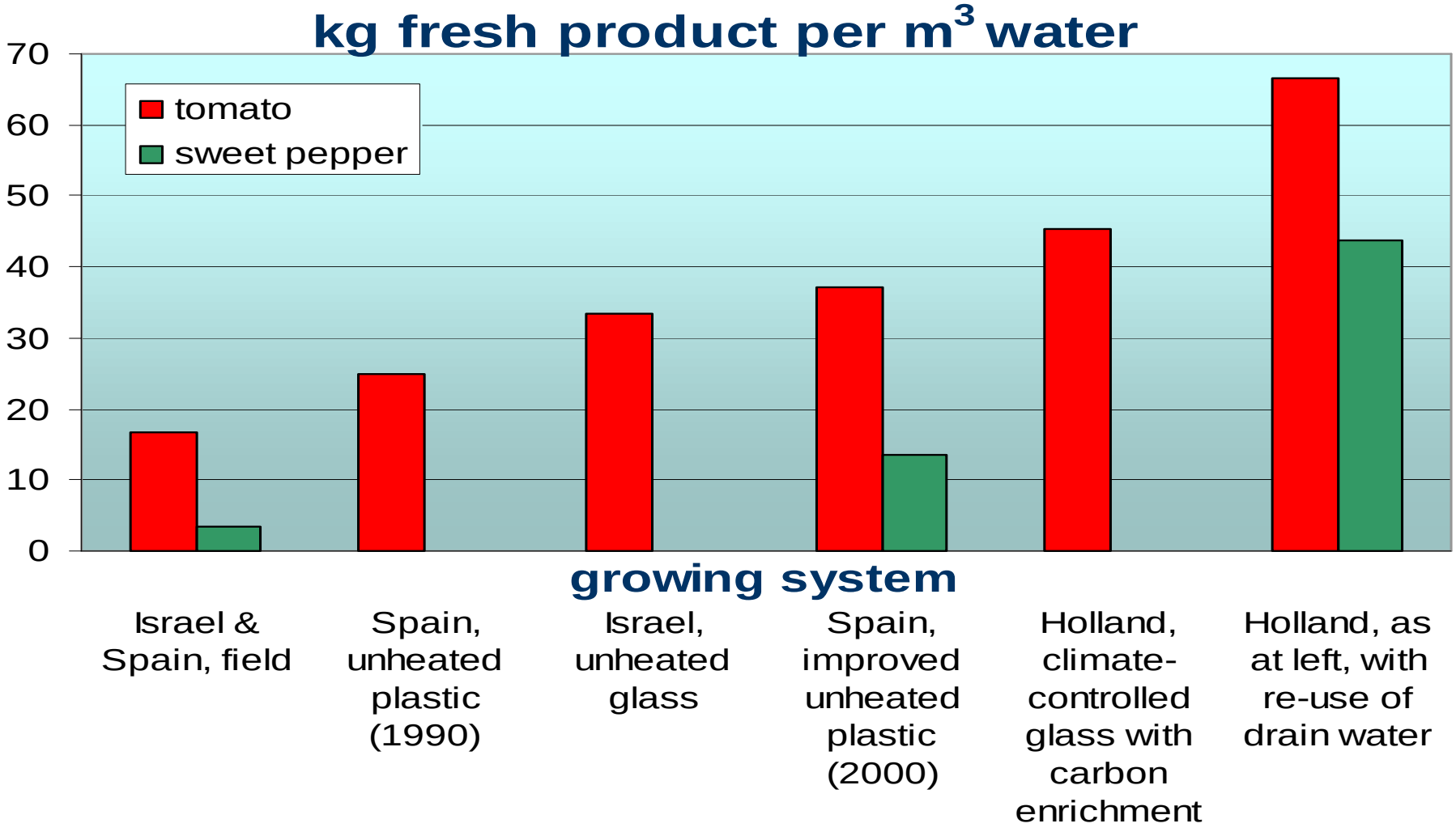

Turkey


Almeria


Trend: Uncovered crops too


Trend: China, Kenya, Ethiopia...

WUE / water foot print / More crop per Drop



Trend: Local and regional approachesare promising

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