Water efficient zero emission glasshouse

Andrew Lee, GRODAN

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2. Precision Growing solutions
3. Increasing legislation & impact on growers future ‘licence to produce’
4. Is zero-emission possible?
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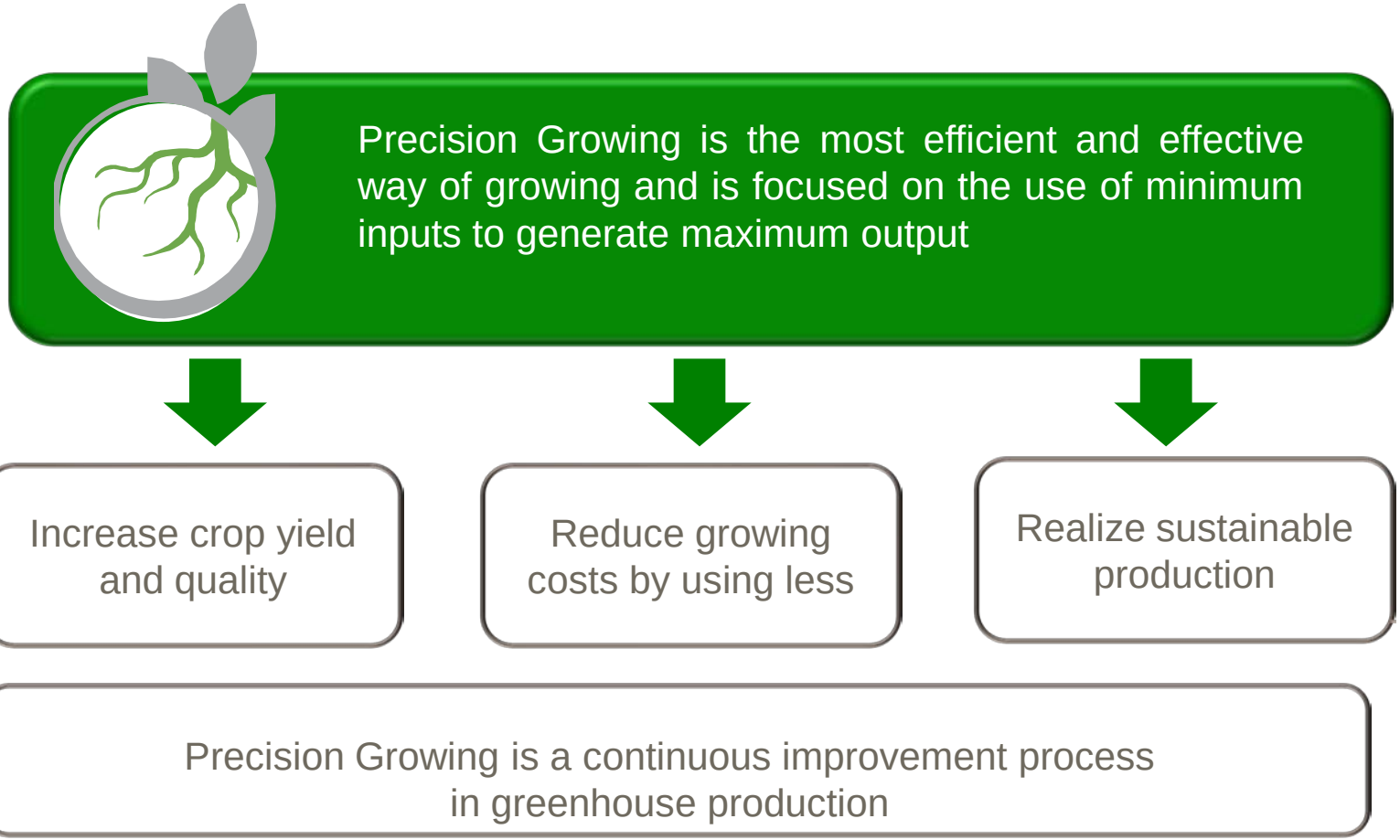
Safe, healthy, nutritious food produced sustainably

Water quality

Resource scarcity

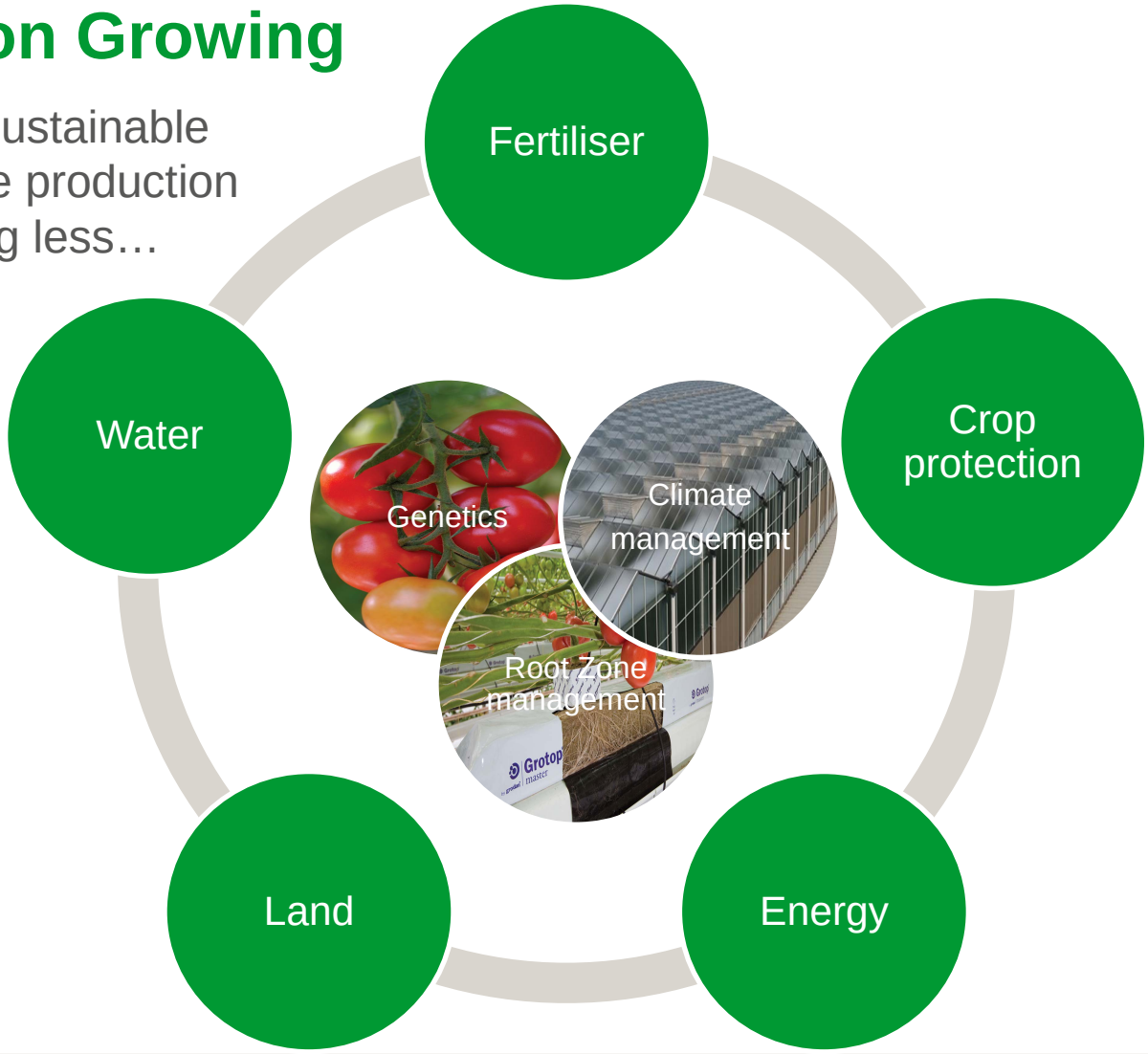
Energy

Precision Growing



Precision Growing

Enables sustainable greenhouse production by using less…



Water use efficiency

1 Kg

60 litres

22 litres

10 litres

Open field	Glasshouse – drain water recycling	Glasshouse + drain water recycling

Next step in drain water recycling

*"Grower's have a social responsibility & it will be a '**licence to produce**' in the future"*

- Guus Meis LTO Glaskracht WUR Water Event 2015

Nitrogen emission targets (kg/ha/year) Netherlands

	2014	2017	2020	2023	2025	2027
Pepper	200	133	100	67	33	0
Tomato	125	83	67	42	21	0
Cucumber	150	100	75	50	25	0

Importance of drain water recycling & impact on water quality

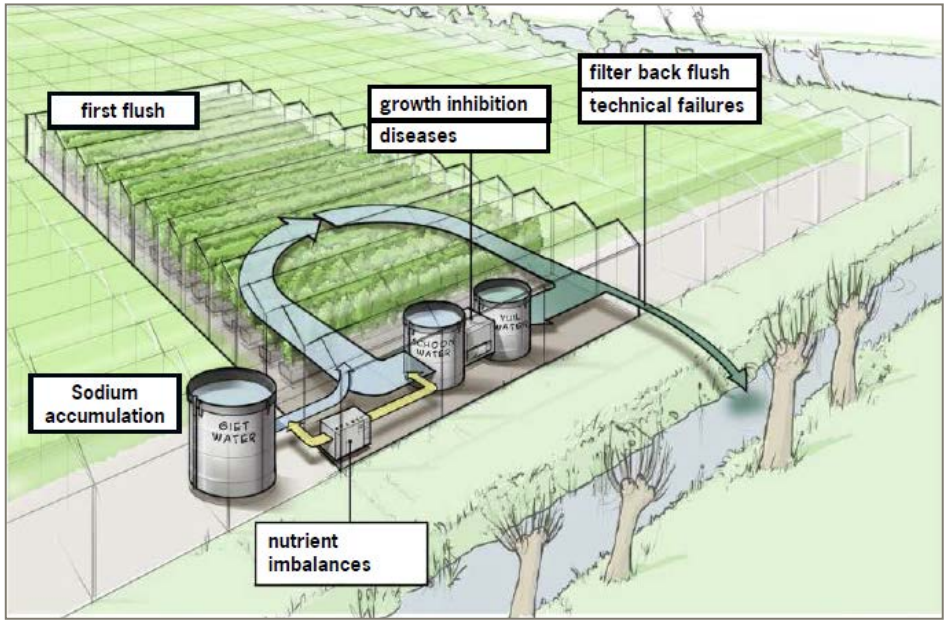
Theorectical emission of nitrogen (kg/ha/year)

Strategy	Nitrogen emission
1. 100% run-to-waste	945 kg/ha
2. Current best practice*: 30% drain & 85% reuse	142 kg/ha
3. Re-using drain water from start cultivation (collection & reuse of first flush)	75 kg/ha

2020 targets (NL)

Reasons to discharge water from the greenhouse

- Sodium accumulation
  - Primary water quality
  - Substrate choice
- Filter rinse water
- Unbalanced nutrient solution during growth
- *"Feeling that re-use lowers production"*
  - *first flush*
- *& right now "just because we can"*



Implementation of closed chains within horticulture is required

J. Aerts and G. Meis. 2015. LTO Glaskracht WUR Water Event 2015.

Substrate growers need to:

- Understand water streams & optimize recirculation systems
- Optimize the irrigation strategy and moment and timing of drain
- Maximize control on leakages within the distribution system

Growers should use three resource packages to reduce emission:

- Prevent excessive drain water
- Re-use collected drain water as much as possible
- Take responsibility to ‘purify’ drain water prior to discharge into the environment

The water efficient & emission free greenhouse

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provincie ZUID HOLLAND

GreenportHortiCampus

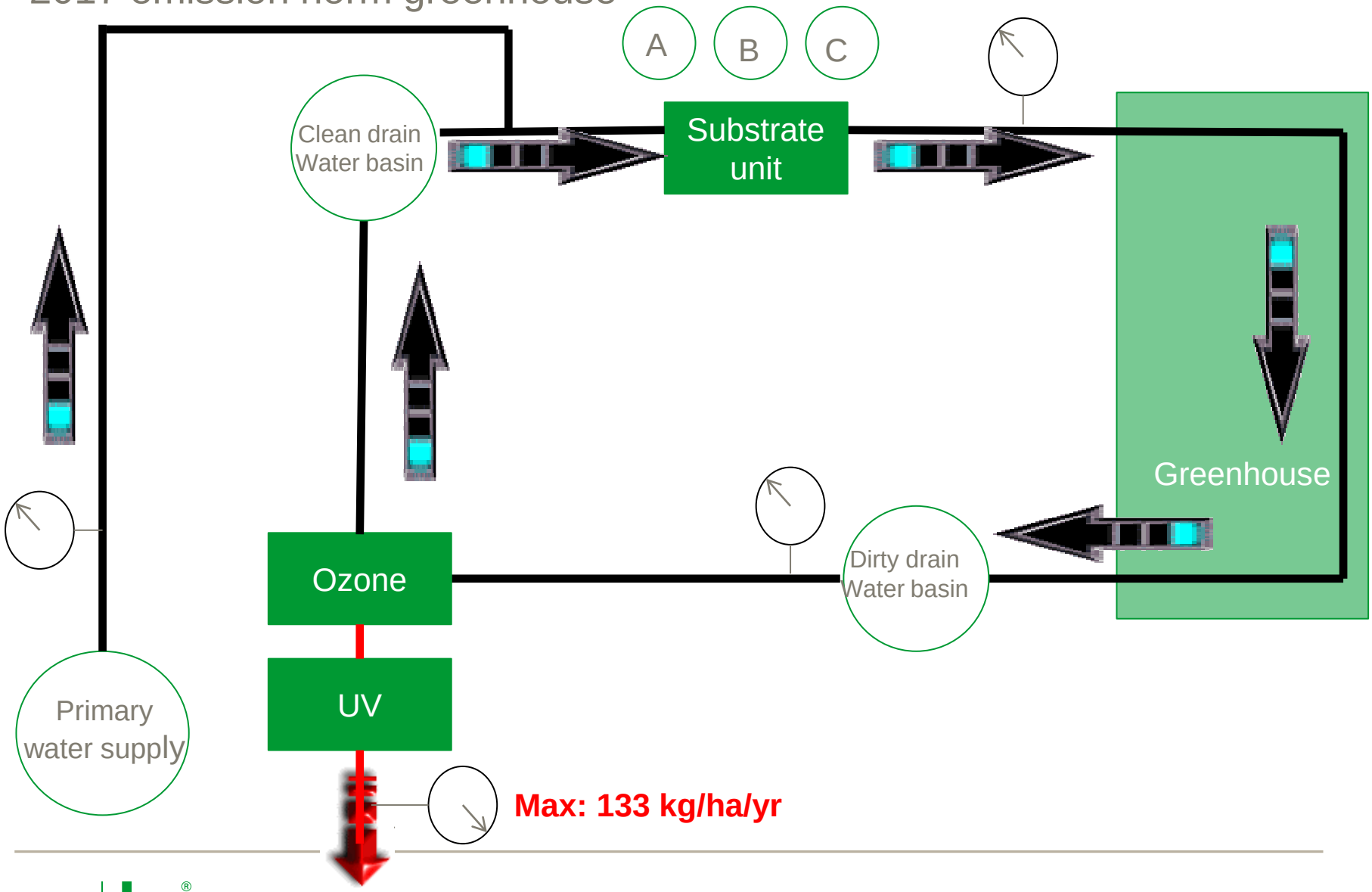
Kansen voor West
G4P4

Hier wordt geïnvesteerd in uw toekomst. Dit project wordt mede mogelijk gemaakt door het Europese Fonds voor Regionale Ontwikkelingen van de Europese Unie en een bijdrage van de provincie Zuid Holland.

Project Goals

- Demonstrate that **zero-discharge is possible** without compromising pepper production & quality.
- Show **how** this can be achieved with correct (& current) technology, system design and approach to root zone management.
- Reveal (as yet) any **unknown bottlenecks.**
- Statement made Canadian Greenhouse Conference 2011

2017 emission norm greenhouse



Nitrate discharge in reference greenhouse “budget” to what is permitted 2015/17

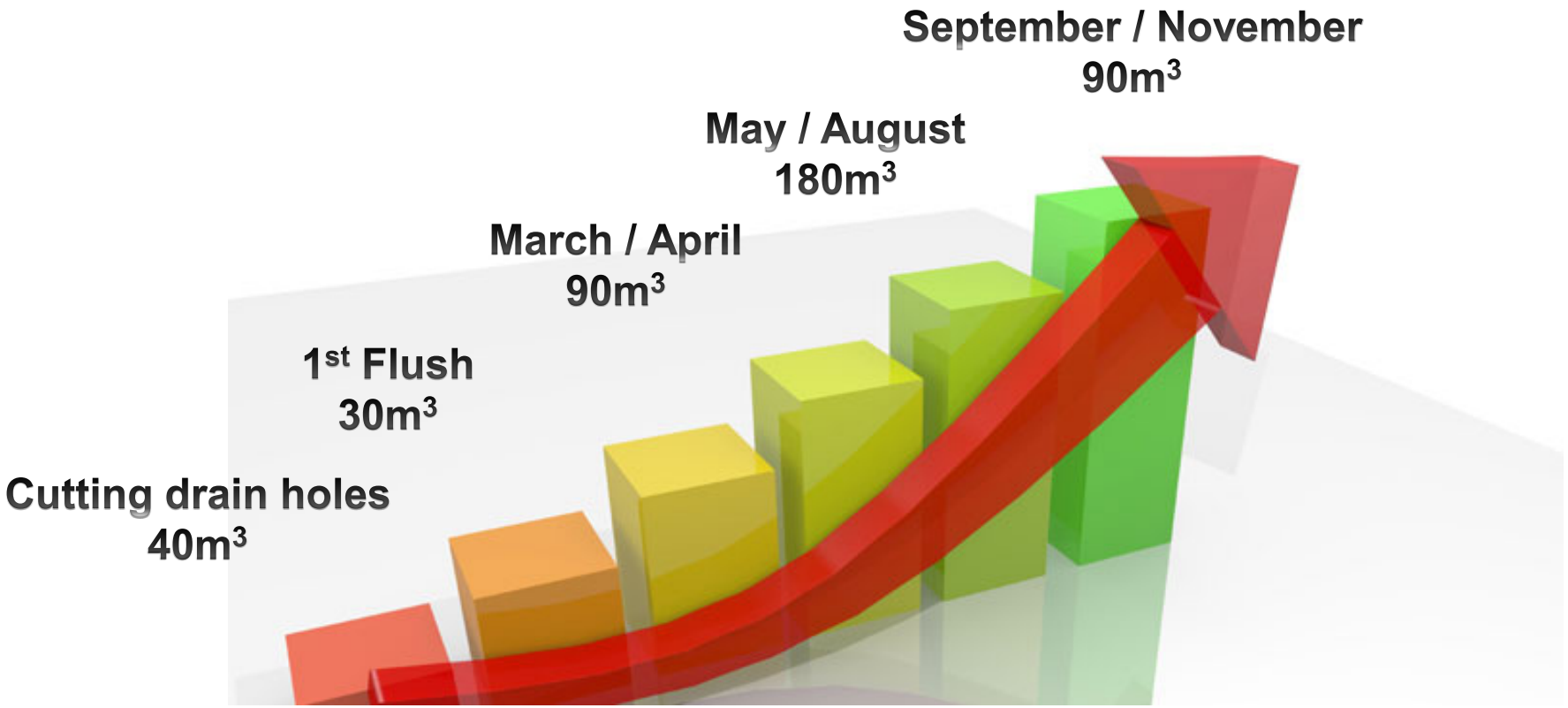
- Sweet pepper emission norm — 133 kg/ha/yr
- Average NO_3 in drain water — 22 mmol/l
- Permitted discharge — 430 m^3/ha/yr

22 x 14 / 1000 = 0,31 kg/m^3

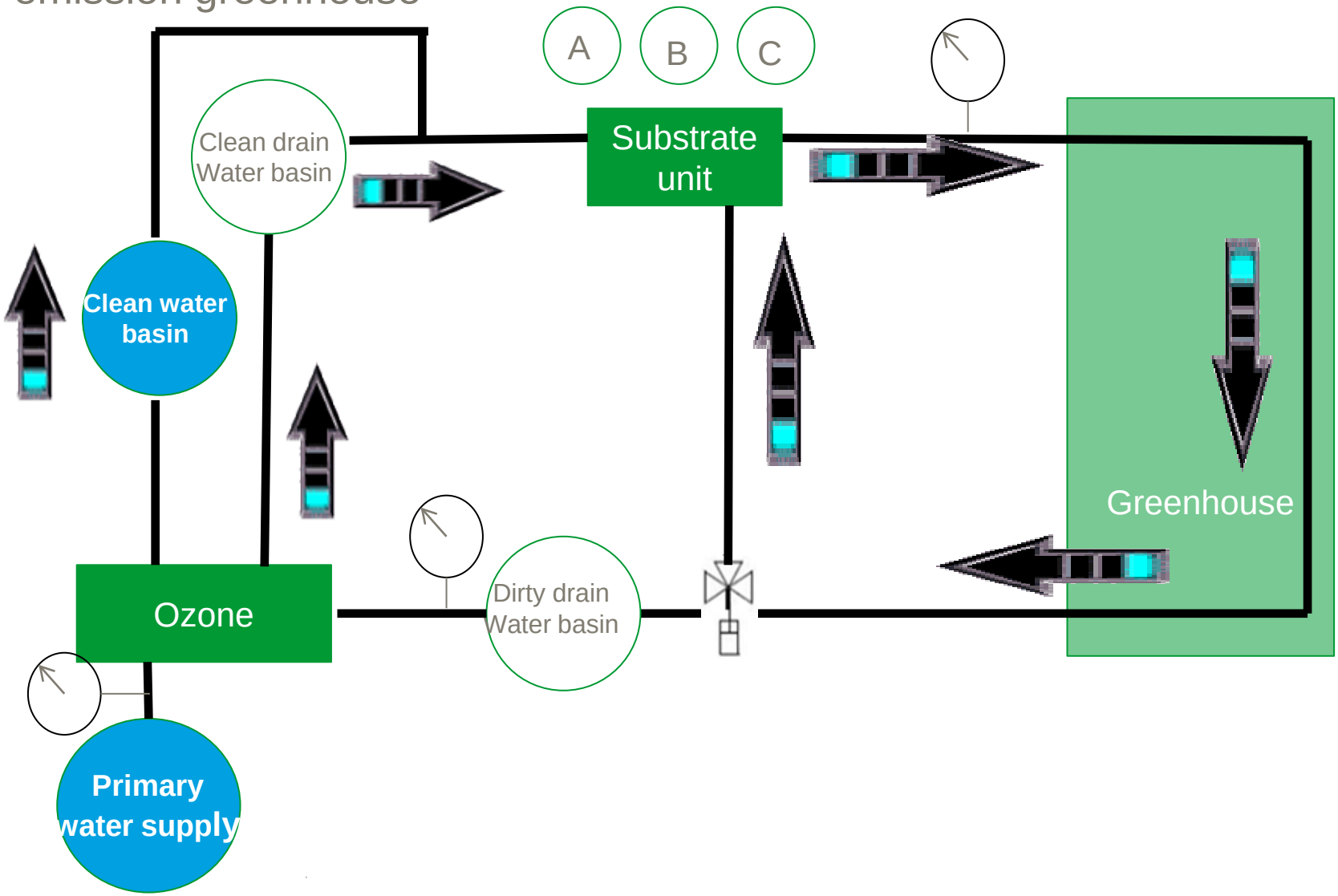
133 / 0,31 = 430 m^3/ha/yr

The discharge budget

2017
430m³
133 kg/ha/year



Zero emission greenhouse

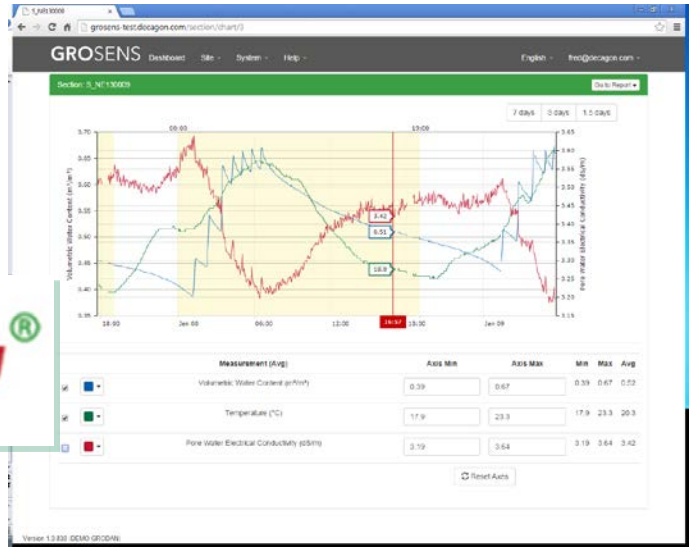


Cultivation

- Variety : Maranello
- Planting date 18th December 2014
- Head density 6.6 /m^2
- Stone wool substrate Grotop Expert
- Primary water supply: rain water
- Nutrient supply analyzed and adjusted on a weekly basis
- Crop steering / management via weekly *'Begeleidings Commissie Onderzoek'* (BCO) meetings

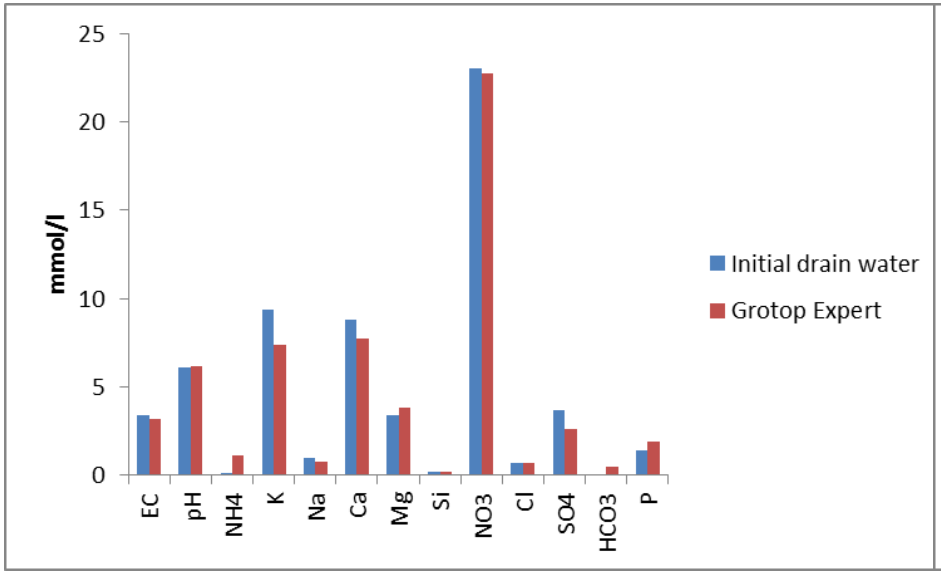
Continuous substrate measurements

- Accurate WC & EC measurement directly in the substrate with GroSens
- Average of 3 measurements per compartment
- Guidance for BCO to optimize the irrigation strategy

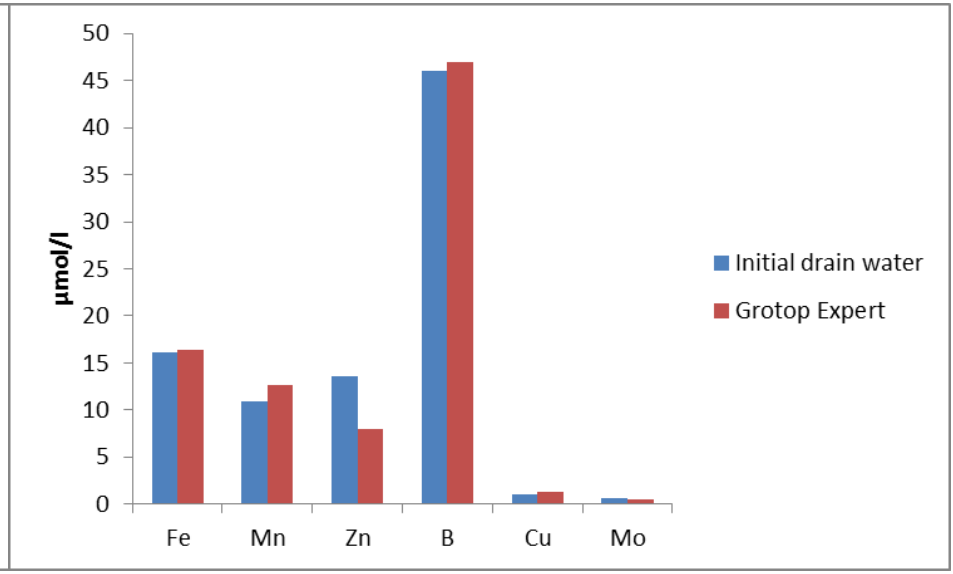


Nutrient balance at the start

Macro nutrients



Micro nutrients



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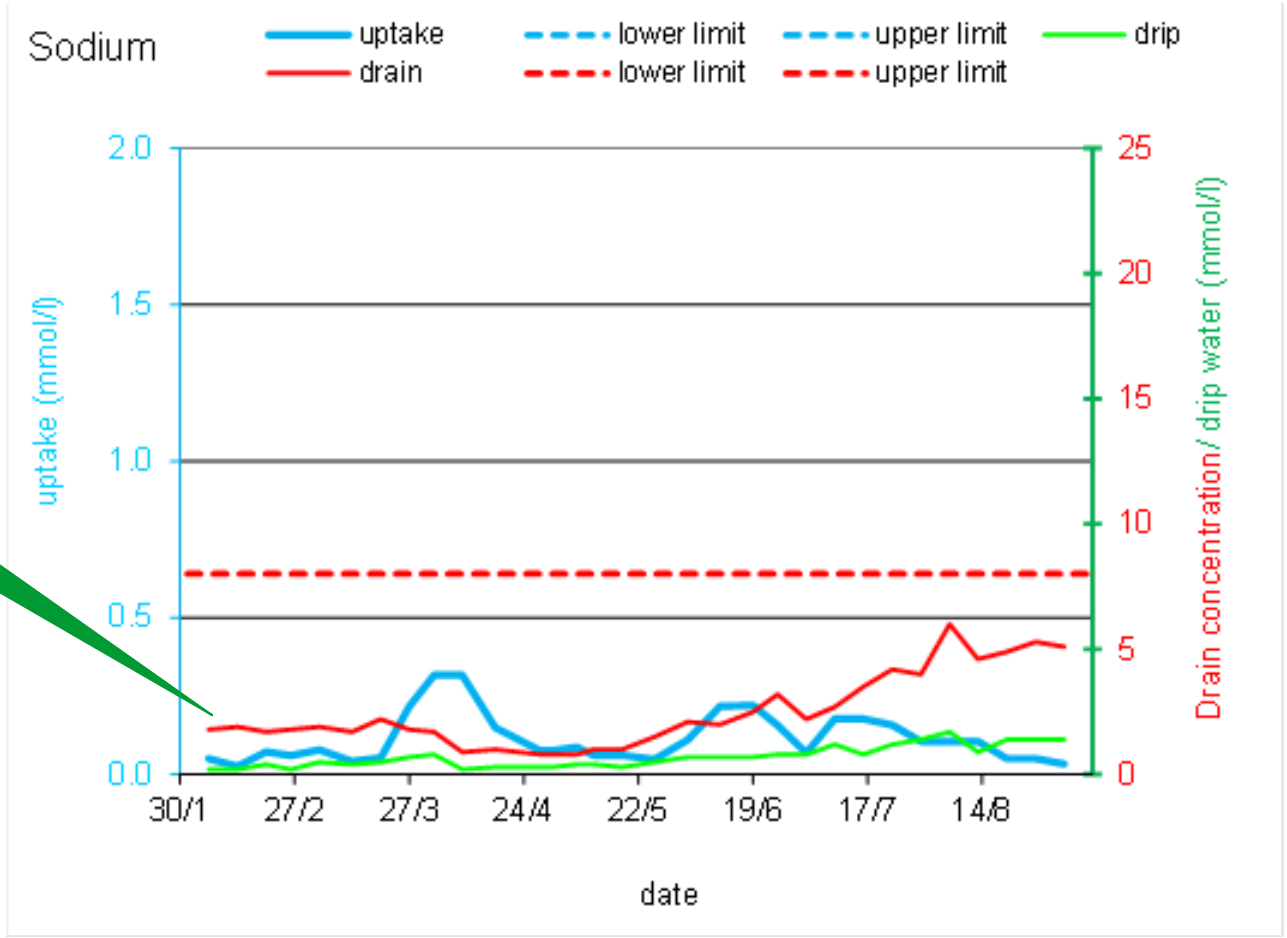
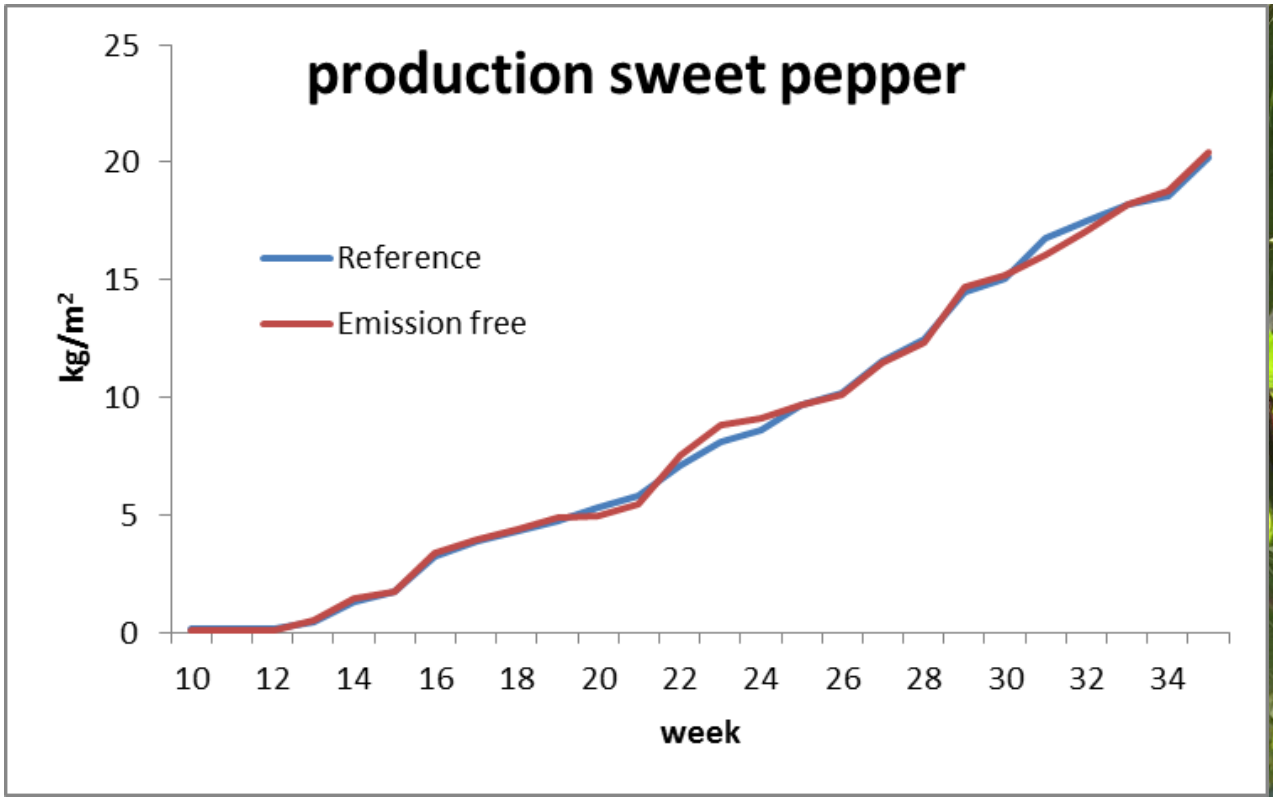
Sodium build up in the system



From the propagator?

No discharge but equal production



Managing nutrient & drain basin levels towards the end of the crop

Target slab values

		Week -5	Week -3	Week -1	Week 0
Nitrate	mmol/l	20	10	5	0
EC	mS/cm^2	3,5	4	4,5	5,0
WC	% v/v	65	50	30	20

Conclusion so far:

Steps & challenges in relation to achieving the drain water emission standards

- Rain water as primary water source, supplemented by RO water when needed.
- Accurate water management to prevent excessive drain water.
- Recycle as much drain water as possible.
- Regular maintenance of irrigation equipment to prevent accidental discharge.
- Na^+ in the system is the only reason why 100% recirculation is not possible.

Hans van der Waal, Dutch pepper grower & member of trial BCO

For more information

- http://www.glastuinbouwwaterproof.nl/

- www.grodan.com

Phil Johnson: Business Support Manager NA

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