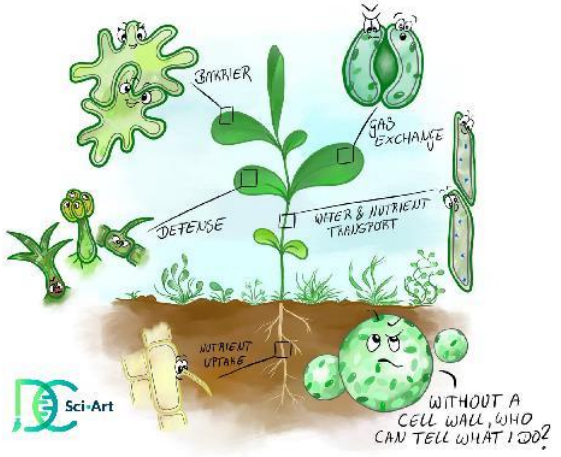
Building resilient soft fruit crops

Jantineke Hofland-Zijlstra (Weerbare Plant)

International Soft Fruit Conference

9 January 2025

Mission statement



‘To stimulate horticultural companies to develop their own monitoring tools and sustainable strategy to develop a healthy and resilient crop’

- Independent R&D advice building resilient crops
- Research support in the greenhouse (on site & with students)
- Training & courses ‘Building resilient crops’, Weerbare Plant

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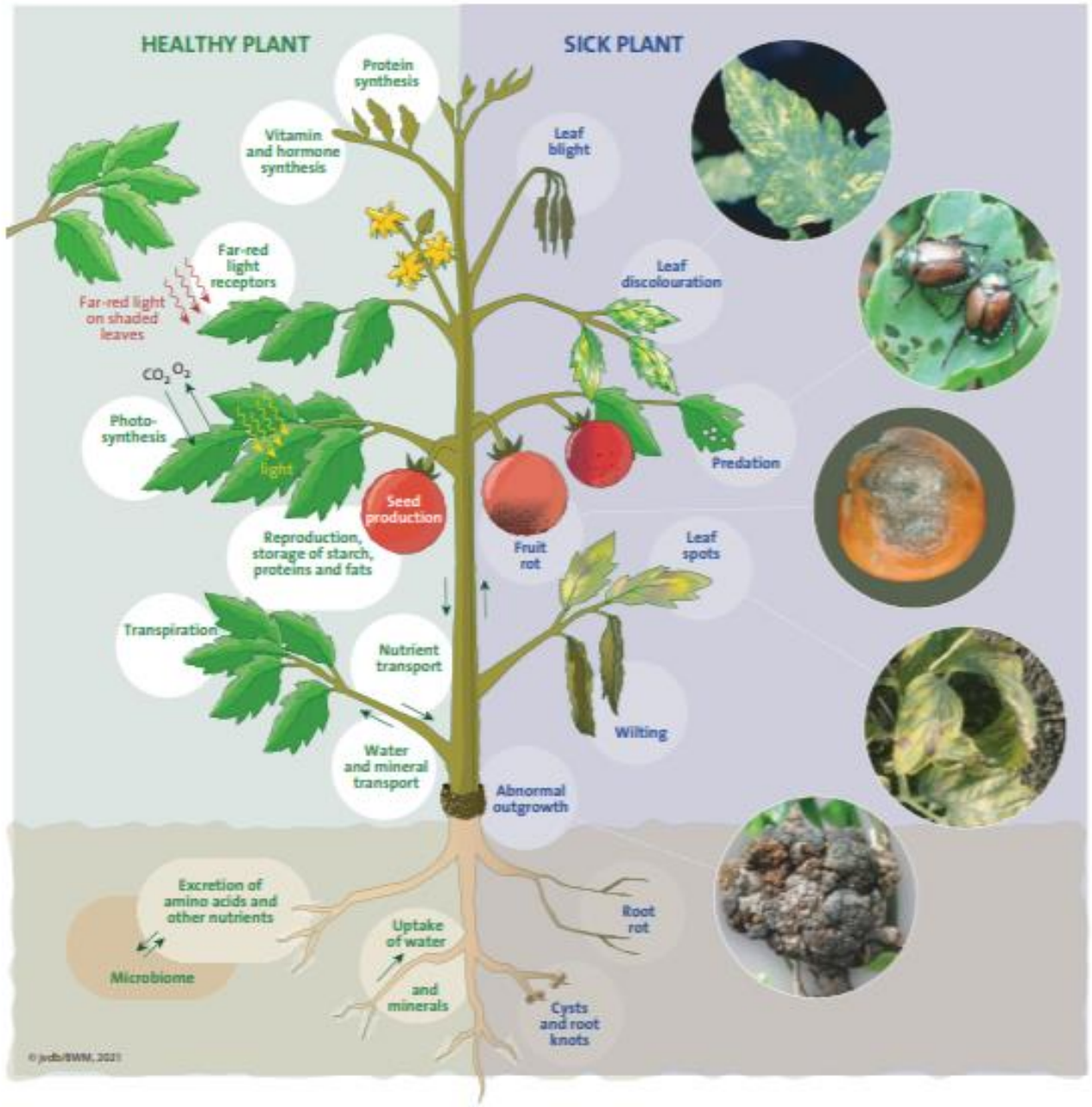
Content

- What is a resilient crop?
- How to build a resilient crop?
  - Example biostimulants
  - Example organic fertiliser
- How to monitor a healthy microbiome?
- Take home message



Source: Dutch Foundation for Biosciences and Society (BWM) Cahier 2, 2021 Plant Health

A healthy plant needs

- Light, water, temperature
- Active root system
- Interaction with soil organisms

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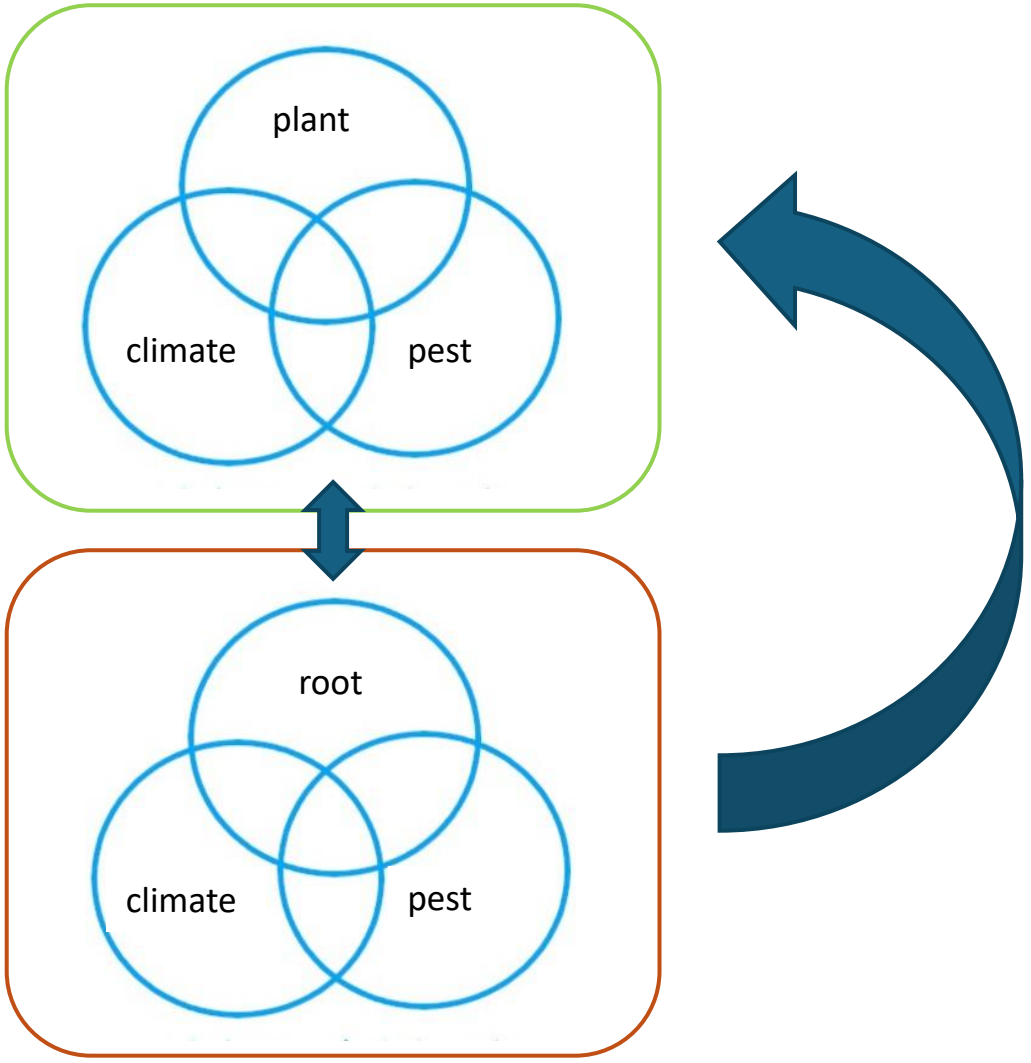
Crop (stem, leaf, flower)



Substrate (coir & slab)

Botrytis
Cladosporium
Alternaria
Meeldauw
Fusarium
Phytophthora
Virus

Pythium
Phytophthora
Fusarium

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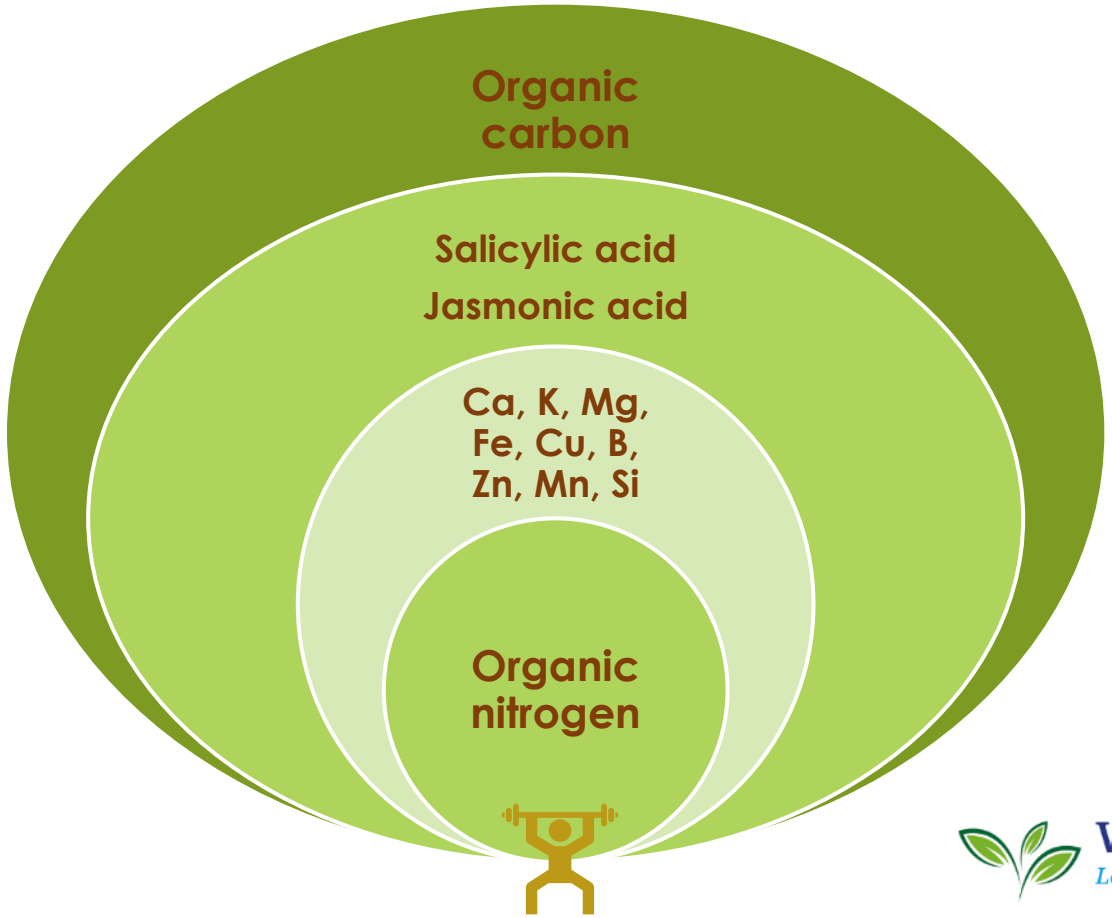
Balance between N (growth) and C (resilience)

- Algae & seaweeds
- Beneficial fungi & bacteria
- Humic & fulvic acids
- Proteins & amino acids



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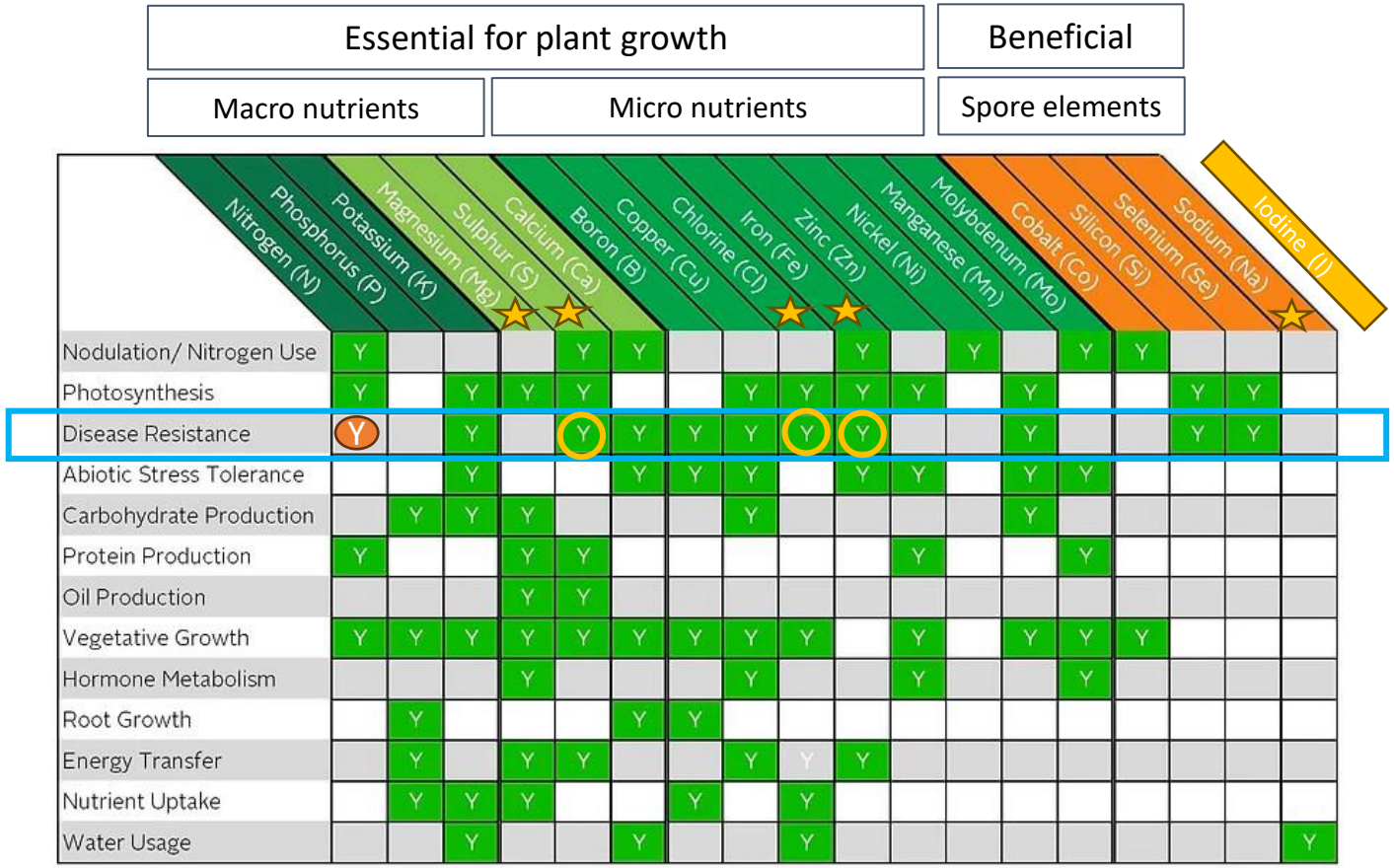
Vidi Fortum (Koppert)

General	Natural biostimulant with seaweds: e.g. Ascophyllum nodosum en Fucus vesiculosus) plant extracts, plus humine- en fulvine zuren.
Active ingrediënts	Seaweeds, humic & fulvic acids (contains growth inducing precursors of cytokinines)
Function	Stimulates vegetative plant growth, Stimulates biological root activity & nutrient uptake Plant support against drought and salt stress
Application	Vegetative growth - Foliar application - Drenching around root zone
Dosage	5L/ha
Package	Liquid biostimulant. Brown colour.

Nutrient elements and plant function



★ Increased after Humic acid addition

○ And related to disease resistance

Source: https://www.nutriag.com/the-essential-plant-nutrients/

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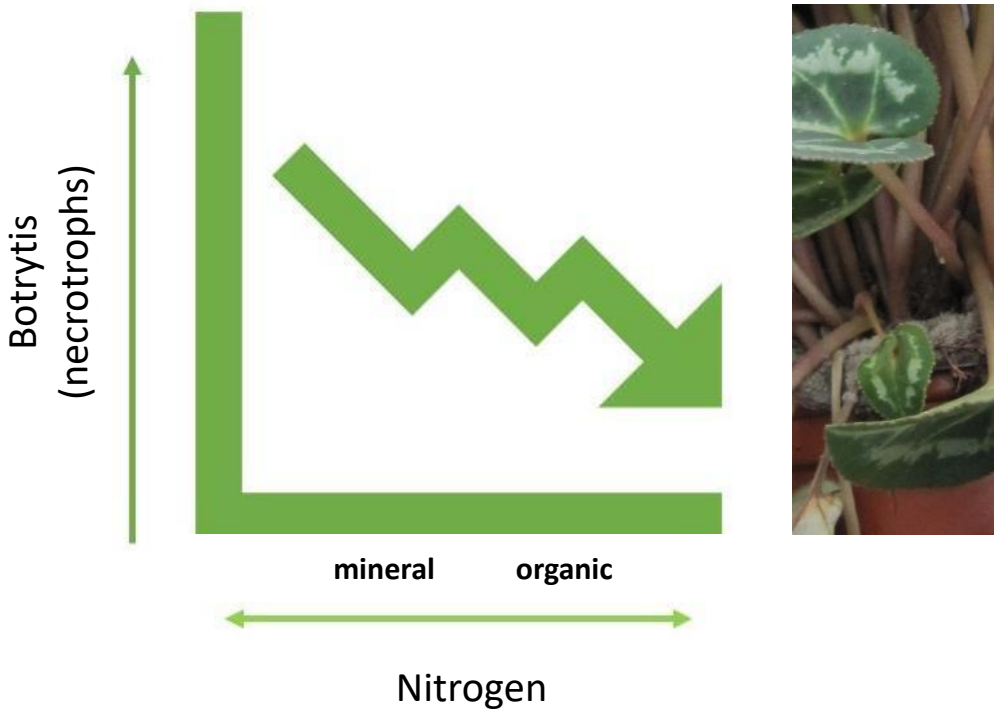
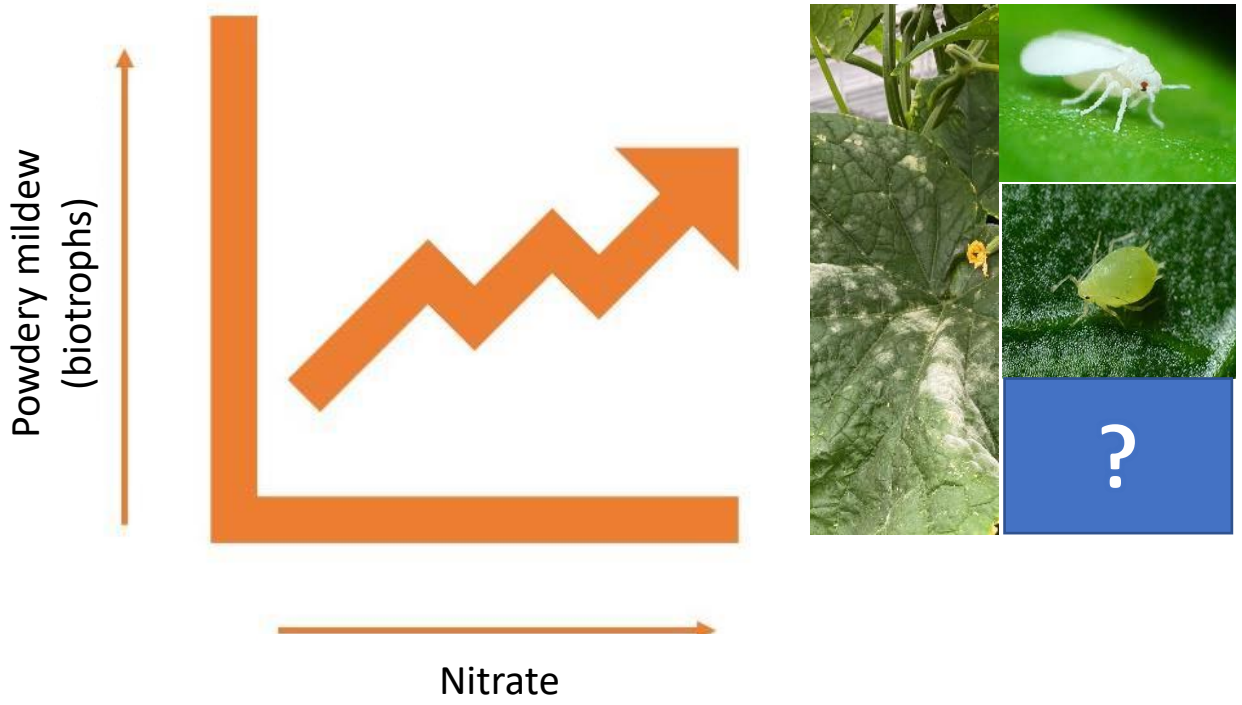
Reduction of nitrate & mineral nitrogen: relation with life cycle of pathogens?





After Kraus ea 1999. Balanced nutrition and biotic stress & Chinta ea 2015. Organic hydroponics against Botrytis

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Resilient substrate (strawberry)

Weerbare Aardbei

Crop at the end of the growing cycle

- Cultivar: Malling Centenary. 13 juli 2023
- Substrate: cocos, peat, bark
- Mineral versus DCM organic nitrogen
- Organic liquid fertiliser with amino acids (Viscotec Blue, jel)
- Foliar fertiliser (trace elements & amino acids)

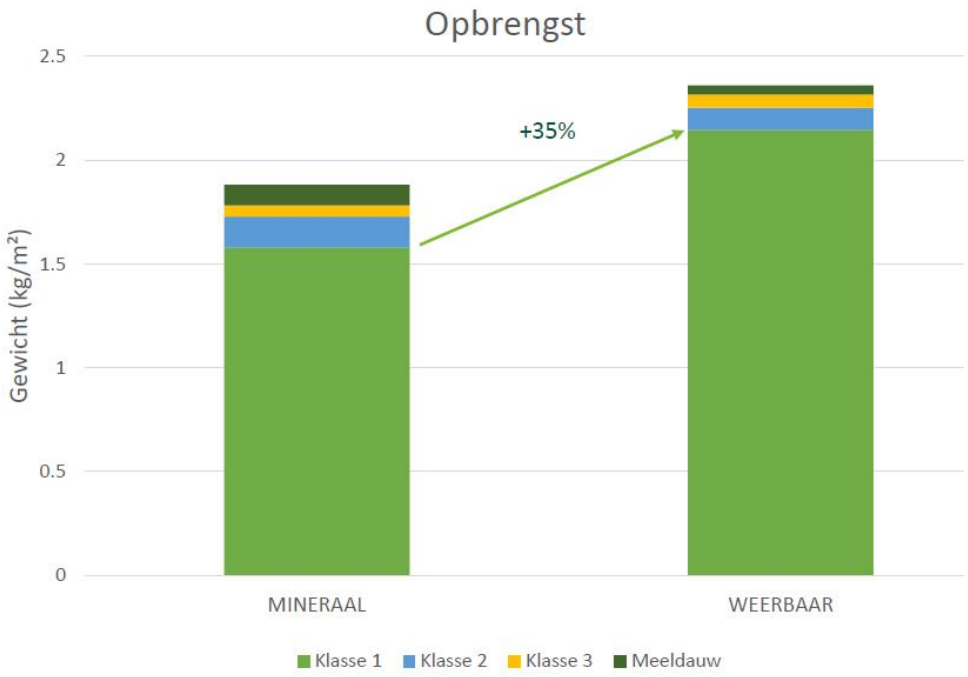
Results:

- Lower nitrate levels & EC
- Higher uptake of silicium & sulphur
- Less insects (whitefly)
- Less diseases (powdery mildew)
- Higher yield & quality

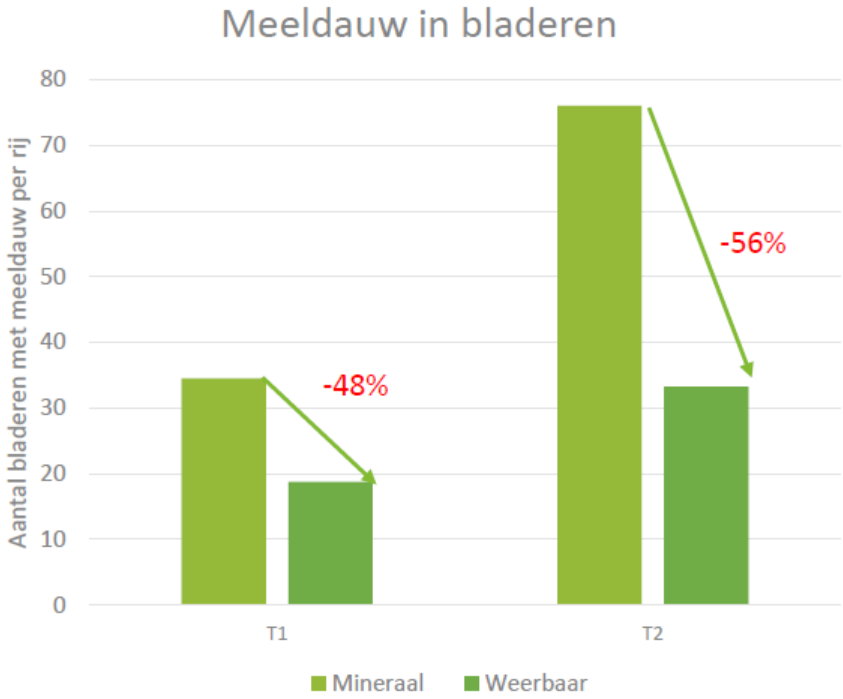
Resilient substrate (strawberry)

Weerbare Aardbei

Cumulative yield



Powdery mildew

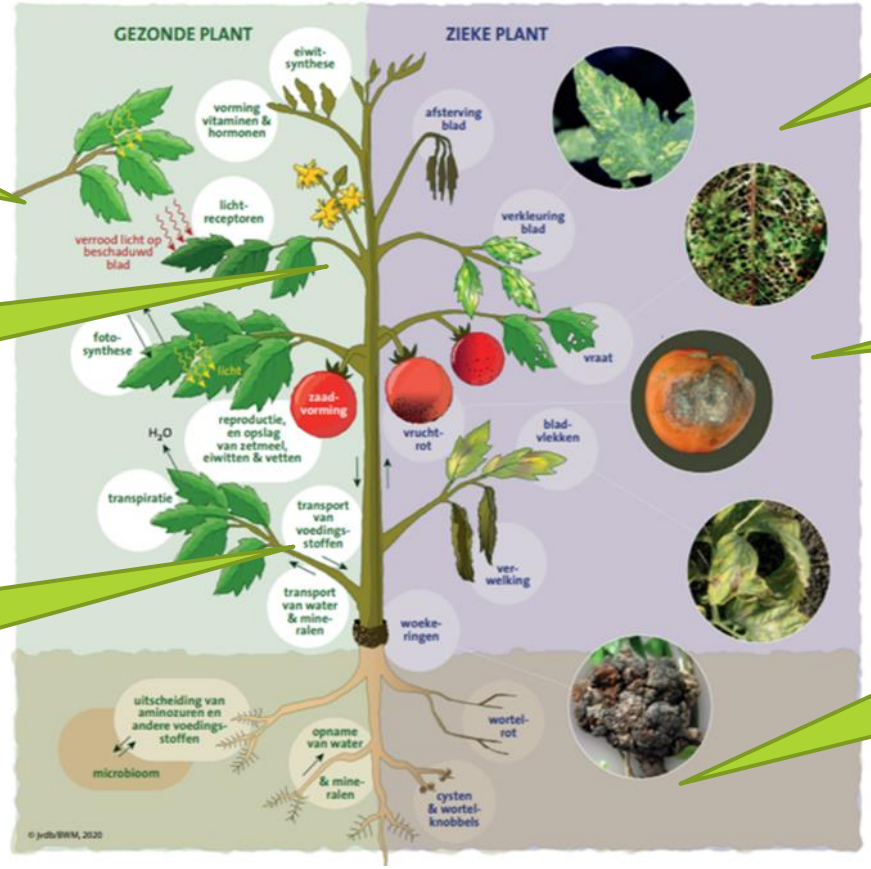


Measurements related to plant resilience

Production

Photosyntheses

Microclimate (leaf wetness)



Nutrients
Dry matter
C:N ratio

Diseases & pests

Substrate (O_2)
Root growth
DNA scan (pathogens)
Soil life monitor

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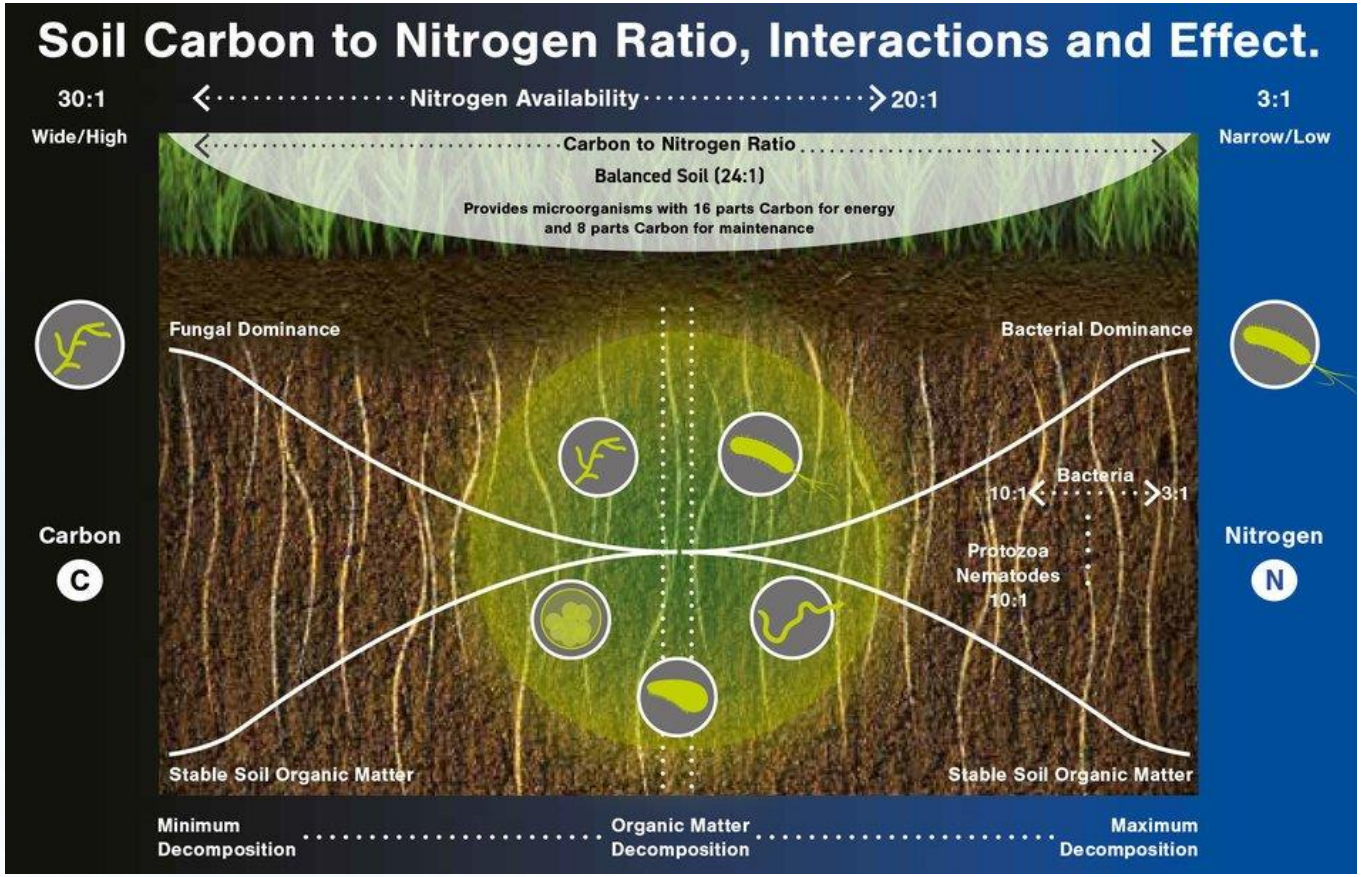
Substrate measurements: C & N



https://www.pitchcare.com/news-media/the-life-in-your-soil.html

- Oxygen levels
- Dry matter (C:N ratio)
- Nutriënts
- Soil life monitor
  - Bacteria vs fungal dominance
  - Organic matter

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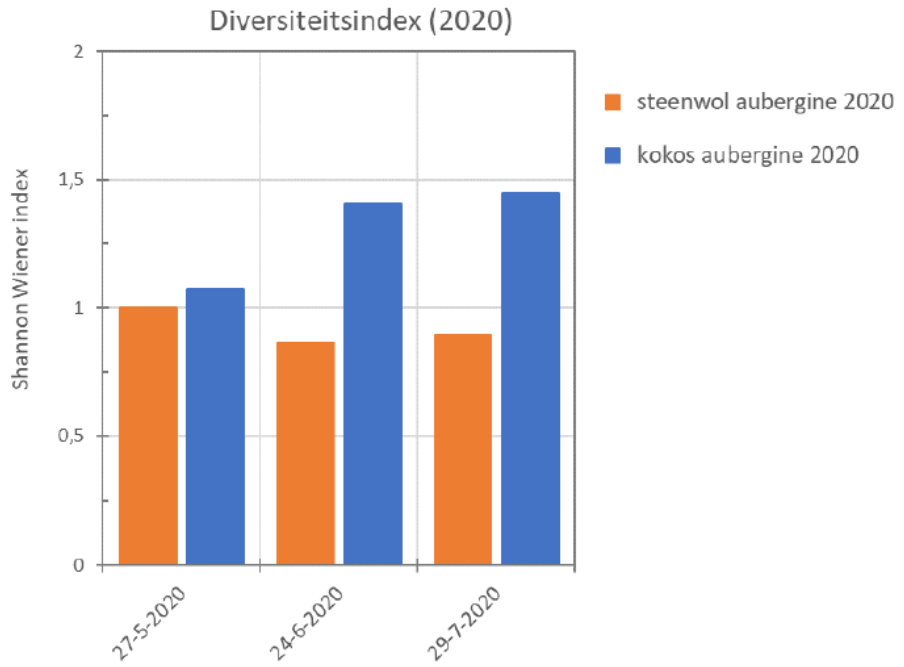
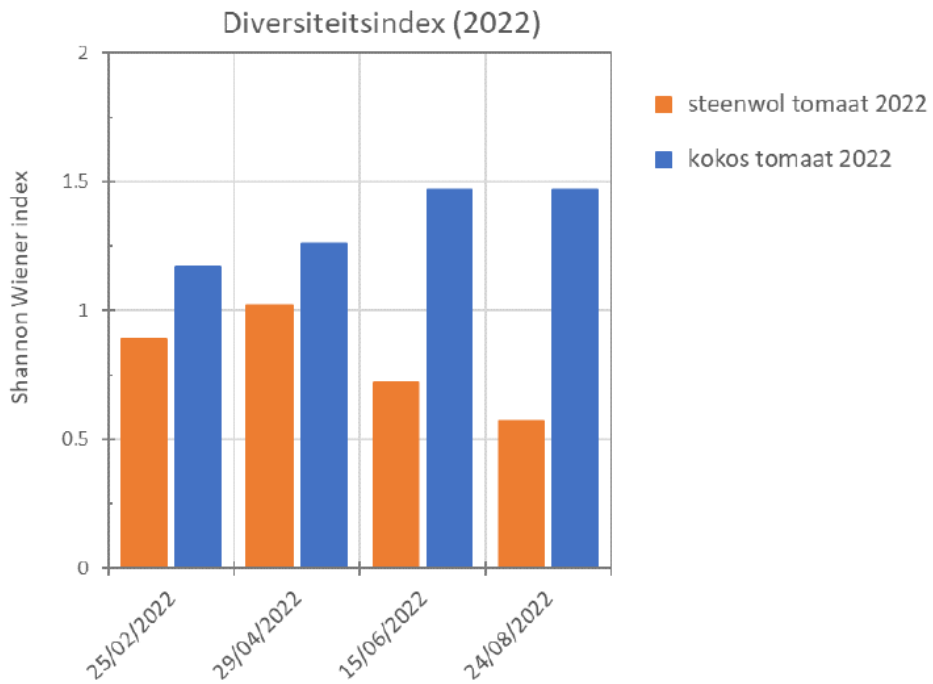
BodemlevenMonitor: hoeveelheid bodemleven

Meten biodiversiteit in de tijd op basis van de BodemlevenMonitor





Source:https://www.glastuinbouwnederland.nl/content/glastuinbouwnederland/docs/themas/Plantgezondheid/Bijeenkomst_Spuittechnieken/Precisie_Gewasbescherming_5_juni_2024/8._Relatie_bodembiologie_en_weerbaarheid_-_Eurofins.pdf

Verschillen in microbioom kokos en steenwol

eurofins

			Kokos			Steenwol		
			T1	T2	T3	T1	T2	T3
bacteriën	*Cellvibrio*	(genus)	66.3	0.8	0.8	31.3	4.5	6.3
	Flavobacterium	(genus)	3.4	16.1	4.8	4.5	17.1	11.7
	Pseudomonas	(genus)	0.7	2.2	1.1	1.7	6.1	11.8
	Streptomyces	(genus)	0.3	3.4	2.7	0.0	0.0	2.6
	Steroidobacter	(genus)	0.0	3.1	2.5	0.0	0.0	0.0
	Bradyrhizobium	(genus)	0.0	0.7	1.2	0.0	0.0	0.0
	Duganella	(genus)	0.0	0.0	0.0	0.2	4.5	0.7
	Xanthomonadaceae	(familie)	0.0	0.0	0.0	0.4	0.0	0.1
schimmels	*Plectosphaerella*	(genus)	1.2	0.5	0.0	2.8	70.7	5.3
	Plectosphaerella cucumerina	(soort)	0.0	0.0	0.0	0.1	0.0	0.3
	Tausonia	(genus)	7.2	2.6	1.8	0.0	0.0	0.0
	Massarina	(genus)	4.1	3.0	1.5	0.0	0.0	0.0
	Myrmecridium	(genus)	3.0	2.3	0.5	0.0	0.0	0.0
	Scedosporium	(genus)	1.8	1.7	0.4	0.0	0.0	0.0
	Phaeoisaria	(genus)	5.2	1.6	0.3	0.0	0.0	0.0
	Sporidesmium	(genus)	0.1	1.0	0.8	0.0	0.0	0.0
	Trichoderma	(genus)	0.1	8.1	1.5	0.0	0.0	0.2
	Cladosporium	(genus)	0.0	0.0	0.1	0.6	0.5	0.4
	Fusarium	(genus)	0.1	0.1	0.5	0.2	1.4	0.4

?

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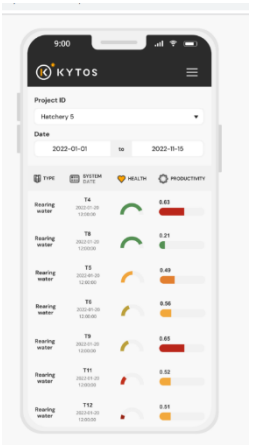
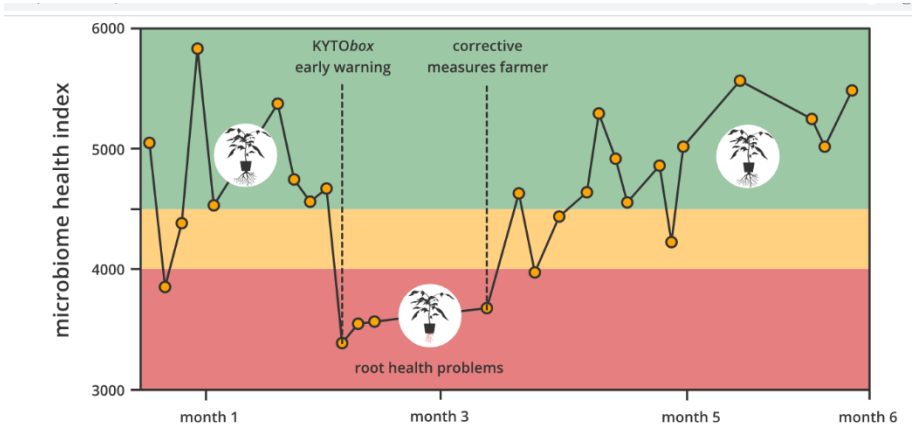
Source:https://www.glastuinbouwnederland.nl/content/glastuinbouwnederland/docs/themas/Plantgezondheid/Bijeenkomst_Spuittechnieken/Precisie_Gewasbescherming_5_juni_2024/8._Relatie_bodembiologie_en_weerbaarheid_-_Eurofins.pdf

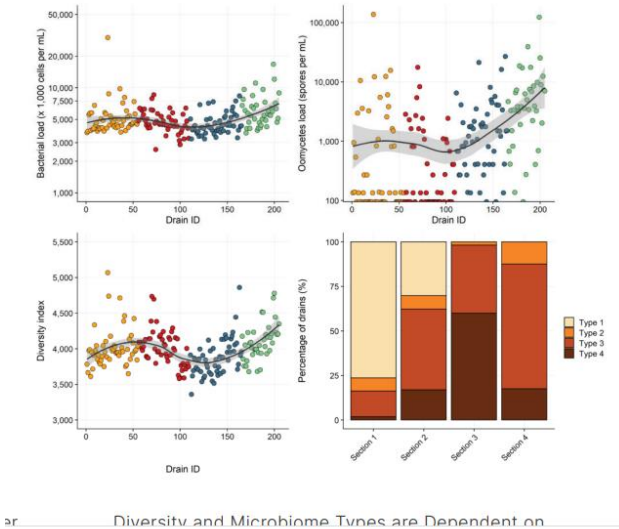
Microbiome monitoring with flow cytometry

- www.kytos.be
- Analyses of bacterial and fungal communities in drain/irrigation water & substrate
- Detection of Pythium and Phytophthora
- Development over time, due to relative low sample costs





Application of the Kytos microbiome health index applied to commercial tomato farm



Diversity and Microbiome Types are Dependent on

IPM project with strawberry growers

- National and regional funding
- Group of 5-8 strawberry growers
- Development of IPM strategie
  - Preventive measures
  - Organic nitrogen (DCM products)
  - Biostimulant tests
  - Measure effects on soil life activity (microbiome)

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Kytos analyses in strawberry

Drainwater	Mineral fertilisation	Organic fertilisation (60%)
Kytos groups		
Total amount of bacteria (x 1000 cells/ml)	> 50.000	< 10.000
Bacterial diversity	2.500-3.000	> 3.000
Microbiome type	3	3
Pythium / Phytophthora (spores/ml)	> 10.000	<1.000
Algae	> 500.000	< 100.000
'Weerbare Wortel' analyse (Normec GAC)		
Germination rate bacteria (cfu/g)	> 500.000	< 10.000
Fungi / yeasts	200	>4000
Other fungi	10	1000

Rijksdienst voor Ondernemend Nederland

Greenport Gelderland

Delphy

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Take home message

- Start your own inventory
  - Substrate improvement
  - Low risk pesticides
  - Biostimulants & organic nitrogen sources
- Start monitoring
  - Plant nutrients
  - Activity of beneficial micro organisms in the substrate
- Just do it!

Thank you!

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