Reuse growing media for circular horticulture

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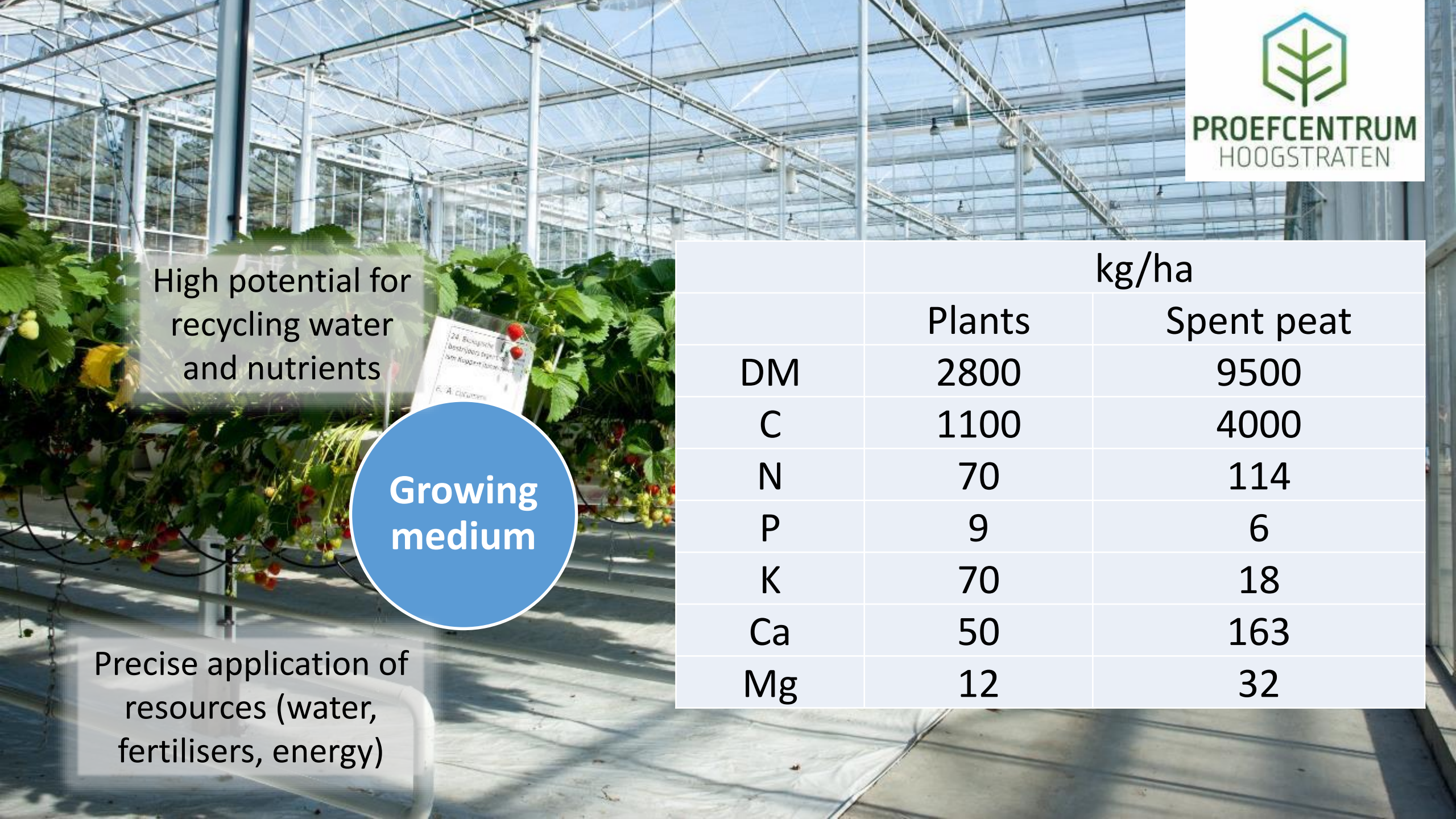
SSCR Soft Fruit Information Day
Winter Meeting, Dundee, 23/02/2023

EJP SOIL
European Joint Programme

PCS inagro ILVO AVBS JoluPlant nv · sa

Europees Landbouwfonds voor Plattelandsontwikkeling:
Europa investeert in zijn platteland



PROEFCENTRUM HOOGSTRATEN

High potential for recycling water and nutrients

Growing medium

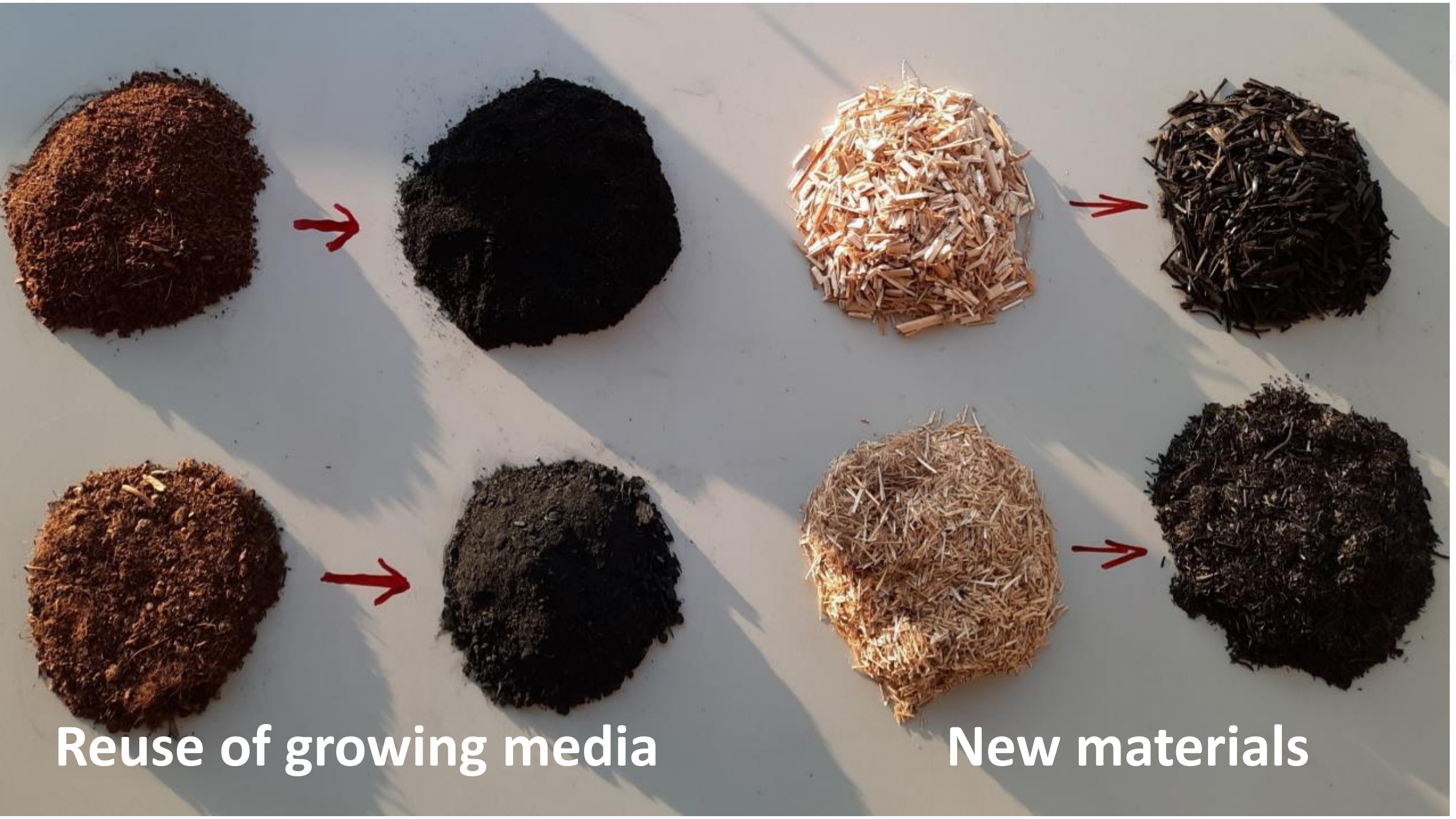
Precise application of resources (water, fertilisers, energy)

	kg/ha	
	Plants	Spent peat
DM	2800	9500
C	1100	4000
N	70	114
P	9	6
K	70	18
Ca	50	163
Mg	12	32

Blok, C., Eveleens, B. and van Winkel, A. (2021). Growing media for food and quality of life in the period 2020-2050. Acta Hortic. 1305, 341-356, https://doi.org/10.17660/ActaHortic.2021.1305.46

Table 4. Total estimated market in 2050 based on the expected market increase (Table 2) and a more realistic estimate of the potentially available materials (Table 3).

	2017 ($Mm^3\ y^{-1}$)	2050 ($Mm^3\ y^{-1}$)	Increase %
Peat	40	80	200%
Coir	11	46	418%
Wood fibre	3	30	1000%
Bark	2	10	500%
Compost	1	5	500%
Perlite	1.5	10	667%
Stone wool	0.9	4	433%
Soils / tuffs	8	33	413%
New		65	
Total	67	283	


Reuse of growing media
New materials

Linear process => circular process?

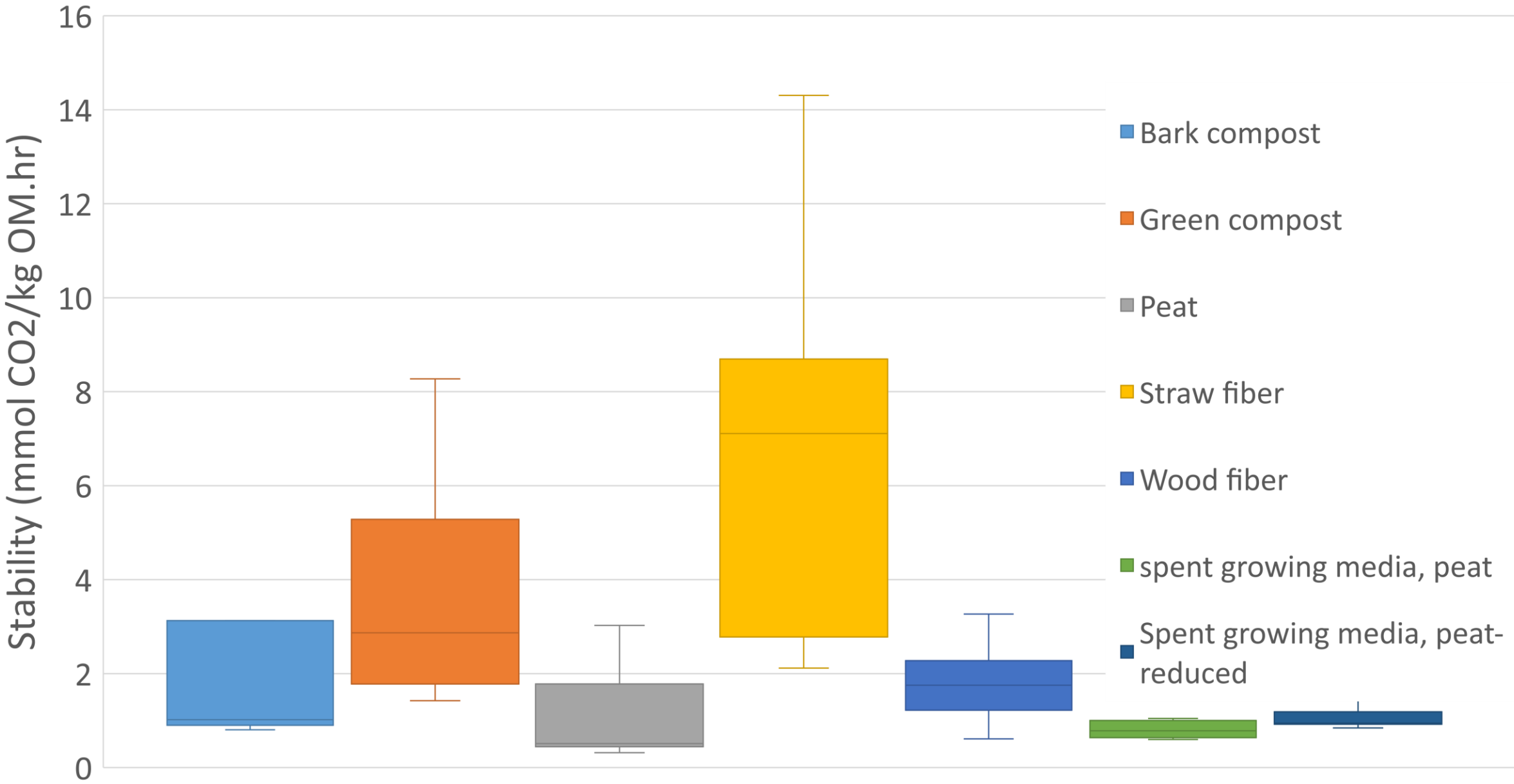
Quality decline of (peat-based) growing media during first use?

- Material becomes less stable?
  - Physical stability?
  - Biological stability (decomposition, oxygen shortage)?
  - Chemical stability (buffering)?
- Accumulation of nutrients, salts, …?
- Pathogens?
- Roots in the growing medium are a problem?

Is there a cost reduction?

How to process the spent growing media?

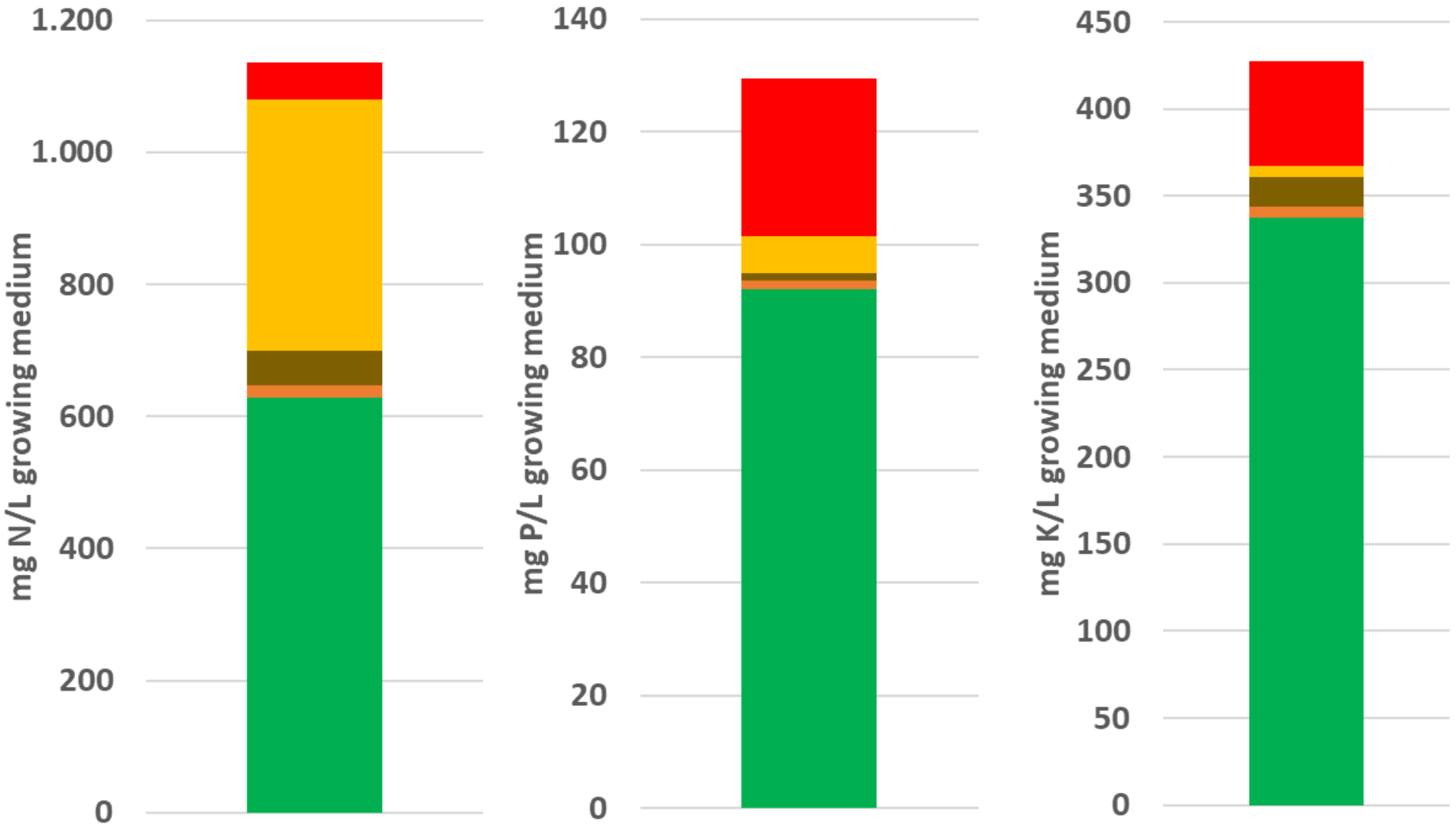
Stability of virgin materials versus spent growing media



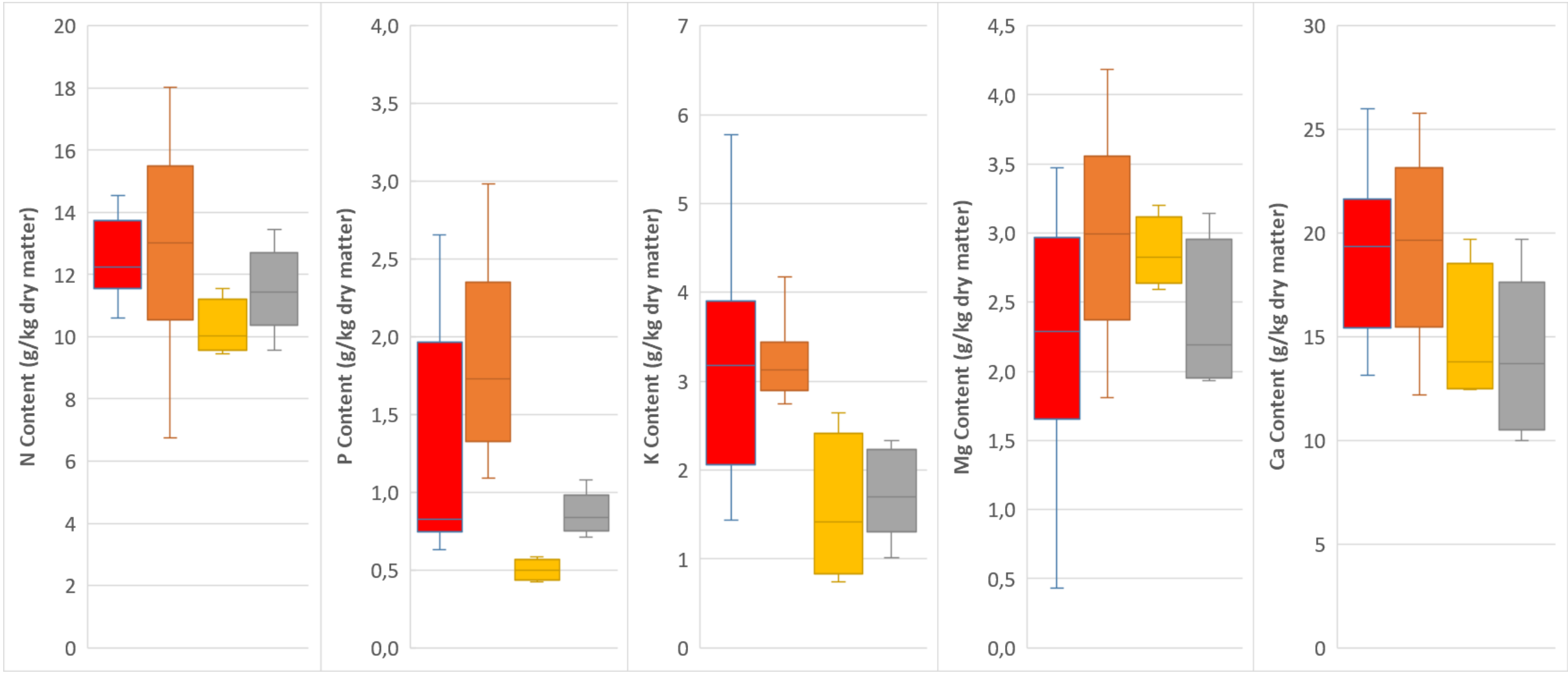
Compost vs compost

Compost = the product of composting

Blend = growing medium



45% peat + 25% wood fibre + 15% green compost + 9% coir + 6% perlite + 0,4 g/L pgmix



Residual nutrient contents in spent growing media for peat-based (yellow) and peat-reduced blends (grey) in trials compared with peat-based (red) and peat-reduced or peat-free blends (orange) from other trials or growers: Potential for reduction of K and P

Linear process => circular process

Acceptable changes in physical properties:

- 13 blends tested for 10 months in autumn-spring strawberry cycle
- 100% peat, 100% coir, peat replacement by compost or by coir/perlite
- air volume at -10 cm increases with 5%, easily available water decreases with 6% and %organic matter decreases with 3% OM/DM

Accumulation of P and K can be managed, blend as a source of P and K for the crop

Spent growing media have a high microbial stability

Pathogens: risk should be assessed per crop

Roots in the growing medium are not a problem

Processing spent organic growing media

Direct use as a soil improver

Bulking agent for composting

Direct reuse/Reuse after sanitation

Feedstock for biochar production

The reuse scenario will affect the fate of nutrients and carbon in spent growing media

Potential of spent growing media?

Growing medium is sold with produce

Growing medium is left

Growing medium with aboveground plants is left

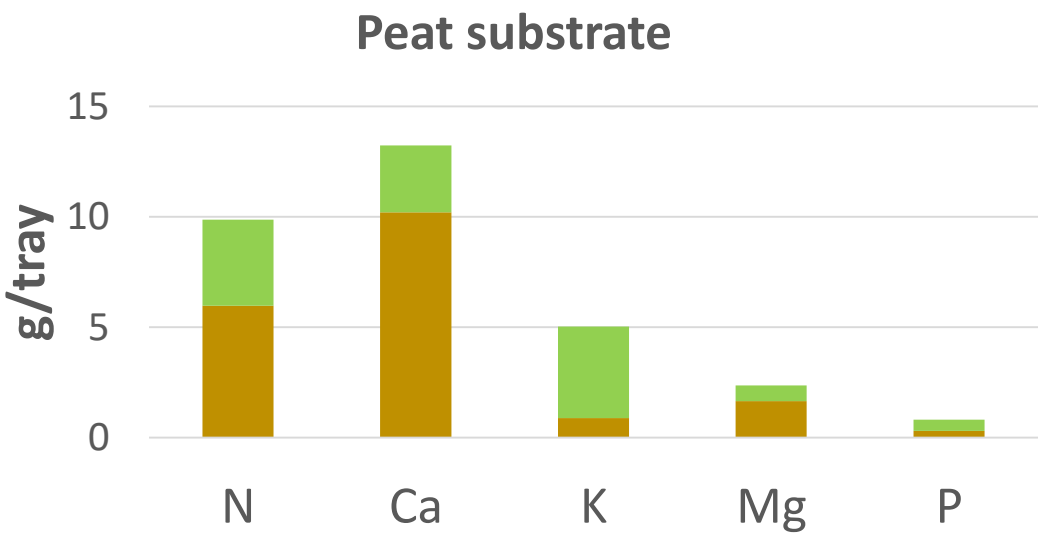
0,70
0,60
0,50
0,40
0,30
0,20
0,10
0,00

Total K (g/L substrate)

0,0
0,5
1,0
1,5
2,0
2,5
3,0

Stability (mol CO_2/kg OM)

Nutrients in aboveground biomass vs spent growing media



Reuse of spent organic growing media: trials

PCS Ornamental Research, reuse steamed strawberry medium for chrysanthemum, only add mineral N: +

Inagro, Different strategies of reuse with/without sanitation, Strawberry, reuse for 3 years: +

NIAB (UK), direct reuse of coir bags for 3 years, strawberry: +

Proefcentrum Hoogstraten and ILVO: potential for reuse of peat-reduced and peatfree blends, strawberry and tomato: high potential

Full scale trials with different growing media

- 6 full scale trials at Proefcentrum Hoogstraten
  - 3 trials with tomato, 3 with strawberry
  - 4 trials of 10 months, 2 trials of 4 months

PROEFCENTRUM HOOGSTRATEN

- Comparison of peat-based blends and/or mineral wool with
  - Strawberry: peat-reduced blends (green compost and wood fiber)
  - Tomato: peatfree blends (green compost, coir, bark and wood fiber)

- No yield decrease with peat-reduced or peatfree blends, sometimes higher yields


GREEN COMPOST
WOOD FIBRE
COCO
PEAT
PEAT
COCO
GREEN COMPOST
BARK
WOOD FIBRE
COCO

Spent media as soil improver

C Stability

Mineral wool

Roots

Spent peat

Peat

Spent peat-red. blends

Spent peatfree blends

Green compost

Wood fiber

C/P ratio

Spent media: Peat / Rockwool / Peat-reduced / Peatfree

		Peat	Rockwool	Peat-reduced	Peatfree	Target Value
Organic C	%/DM	47	4	35	39	high
C mineralisation rate	mmol CO2/kg C hr	1.4	14.5	2.2	1.4	low
Total P	g/kg DM	1	3	1	2	low
Total K		3	7	2	2	low
Total Mg		4	49	3	3	low
Total Ca		19	109	16	17	low
C/N	(-)	42	5	27	39	>25
C/P		639	12	336	195	>150
CEC on DM basis	cmolc/kg DM	105	9	61	64 b	high

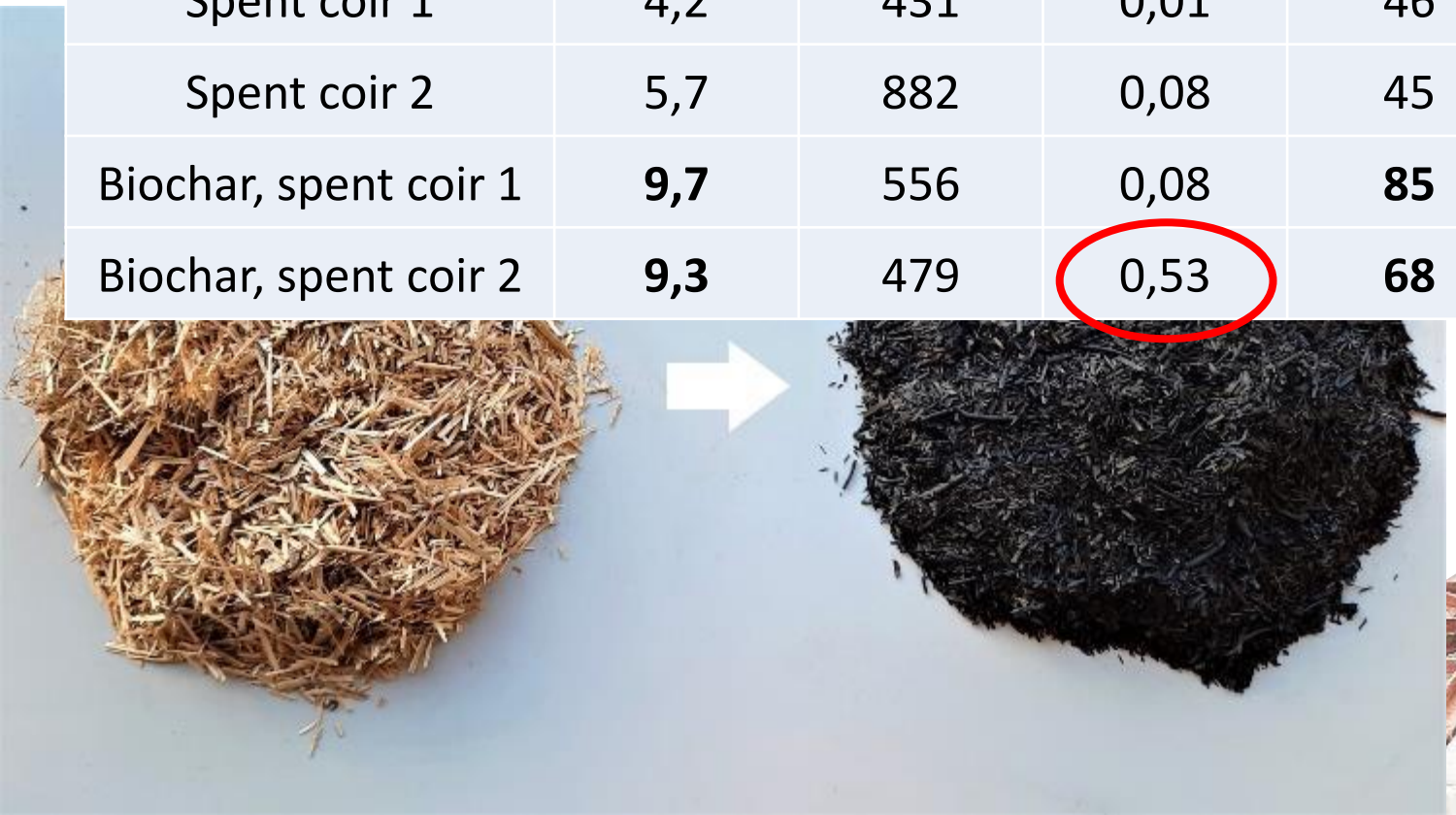
Peatfree vs. peat-reduced vs. peat:high C stability, high org. C content vs. high C/N and C/P, low N mineralisation, high value as soil improver

Reuse growing media?

Where?	Need for sanitation	Plant biomass included?	Operational in Belgium?	Recovered volume of SGM
Direct reuse at the grower	Assessment based on previous cultivation	Grower's choice	Yes	>90%
Reuse by other grower	Necessary	Grower's choice	Yes	>90%
Thermal treatment for sanitation	In the process	Avoid for better process	Investments ongoing	>90%
Compost facility	In the process	Green material needed for the process	Yes	>70%
Pyrolysis facility	In the process	Avoid for better process	Testing at lab scale	>50%

Spent coir: feedstock versus biochar

Material	pH-H2O	EC	IC	OC	P	K	CEC
	-	µS/cm	%/DM		g/kg DM		cmolc/kg
Spent coir 1	4,2	431	0,01	46	1,7	3,7	84
Spent coir 2	5,7	882	0,08	45	1,1	2,5	101
Biochar, spent coir 1	**9,7**	556	0,08	**85**	**3,5**	**13,1**	**37**
Biochar, spent coir 2	**9,3**	479	0,53	**68**	**2,6**	**7,3**	**20**



Reuse: Scoring the suitability for use in growing media

LOW 1

Suitability score for use in growing media blends: Peat, fertilizer and lime replacement value

HIGH 16

Score = pH + EC + OM + nutrients + IC + OUR + N_{immob} + Bulk dens.

Score: 12-13

Nutrient content: x 2

Score: 10-13

Score: 9-12

More info: https://www.mdpi.com/2073-4395/11/4/629

Reuse of growing media: guidelines

Reuse (a) **bulk material**, (b) **carbon** and (c) **nutrients**

Direct reuse, reuse as compost or biochar:

Take residual nutrients into account

(s)low N mineralization rate ⇔P and K highly plant available

Aboveground biomass: important source of nutrients

Fertigation can reduce P and K accumulation

Compost based on spent growing media = high potential for peat replacement

Compost/biochar:

Differentiate between bulk materials and organic fertilizers => If nutrient levels are low: bulk, if high: organic fertilizer

Biochar

Mode of action: chemical
Effect: microbiological

Chitin

Mode of action: microbiological
Effect: chemical

Elemental S

Mode of action: microbiological
Effect: chemical

Horti-BlueC webinar 1: Large scale gasification for energy and **biochar** production

More info
Recording
Factsheet

Horti-BlueC webinar 2: Production of chitin from shrimp shells or Chinese mitten crab

More info
Watch recording
Factsheet

Horti-BlueC webinar 3: Spent growing media for direct reuse or as a feedstock for **biochar** and compost

More info
Watch recording
Factsheet

Horti-BlueC webinar 4: New growing media blends for strawberry and tomato

More info
Watch recording
Factsheet

Horti-BlueC webinar 5: LCA on **biochar** in new growing media blends for strawberry and tomato

More info
Watch recording

Building blocks for sustainable growing media with a focus on microbiology: more info?

	Video	Fact sheet	Paper
Chitin	https://youtu.be/yUymPsQwS44	Chitin fact sheet	Chitin from shrimp shells or crab Chitin in Strawberry Cultivation
Biochar	https://youtu.be/jiccJc9d-Gg https://youtu.be/9YpdSjLu-Zc	Biochar fact sheet	Biochar for Circular Horticulture Strawberry Rhizosphere and Biochar
Spent growing media	https://youtu.be/MXcMc0vS0f0	Spent growing media fact sheet	Grow - Store - Steam - Re-peat
Green compost		Microbiome of growing media	Composts versus woody management residues Woody composts and organic fertilizers
Plant fibers	https://youtu.be/fCiJ_20c8FQ	New growing media fact sheet	Plant fibers for renewable growing media

BASTA

Thank you!

This project has received funding from the Interreg 2 Seas Programme 2014-2020 co-funded by the European Regional Development fund under subsidy contract No 2S03-046 Horti-BlueC

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