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Research Foundation Flanders
Opening new horizons

CMK CENTRUM VOOR MILIEUKUNDE UHASSELT

ILVO
Instituut voor Landbouw-, Visserij- en Voedingsonderzoek

Welcome

Final event BASTA

28/09/2023 – 12h until 17h30 – Euroscoop/Pathé, Maasmechelen

Thank you very much for coming from the BASTA team:

CMK CENTRUM VOOR MILIEUKUNDE UHASSELT

ILVO
Instituut voor Landbouw-, Visserij- en Voedingsonderzoek

Many thanks to our co-organizers:

PATHÉ!

De Muizenval
l'appetito vien mangiando

Agenda

12h00 Sandwich lunch @ Euroscoop

13h00 Highlights BASTA project – Prof. Dr. Ann Cuypers & Dr. Bart Vandecasteele

13h15 Biochar in strawberry cultivation – Dr. Jane Debode

13h45 The added value of biochar – Drs. Luca Campion

14h00 Biochar's Flemish policy - Katleen Van den Eynden (OVAM)

14h30 Walk to the Ecotron

14h45 Ecotron tour – Prof. Dr. Natalie Beenaerts & Prof. Dr. Nadia Soudzilovskaia

16h00 – 17h30 Reception @ Euroscoop

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ILVO Instituut voor Landbouw-, Visserij- en Voedingsonderzoek

Highlights BASTA project

Dr. Bart Vandecasteele & Prof. Dr. Ann Cuypers

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BIOCHAR'S ADDED VALUE IN SUSTAINABLE LAND USE WITH TARGETED APPLICATIONS IN PROCESSES, GROWING MEDIA & (FUTURE PROOF) OPEN-FIELD

WP1 BIOCHAR

WP2 PROCESSES

WP3 GROWING MEDIA

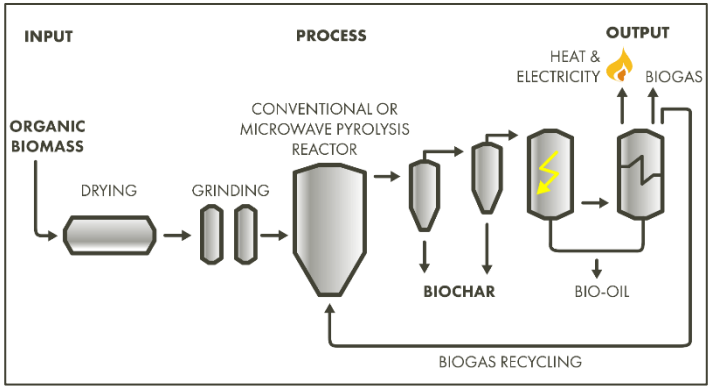
WP4 OPEN-FIELD

WP5 INTEGRATED ASSESSMENT

WP1 – TAILORED BIOCHAR PRODUCTION

Prof. Dr. Dries Vandamme

Drs. Amine Lataf



Lataf et al., 2022. **The effect of pyrolysis temperature and feedstock on biochar agronomic properties** - Journal of Analytical and Applied Pyrolysis

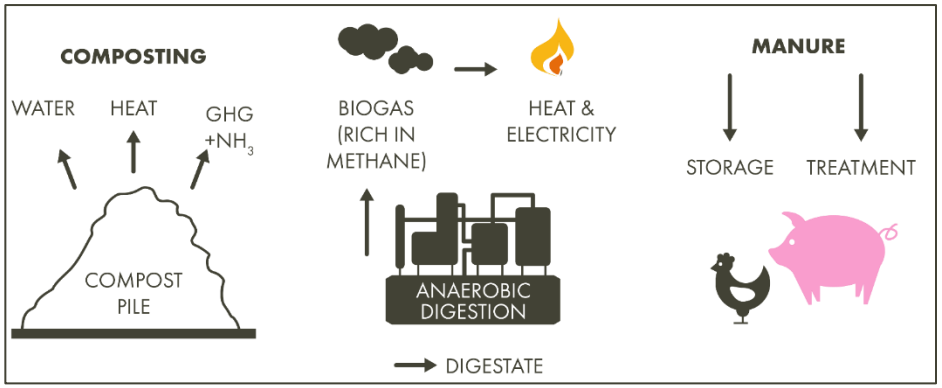
Lataf et al., 2023. **The screening of various biochars for Cd^{2+} removal at relevant soil pH** - Waste management

Lataf et al., 2023 **Co-pyrolysis of chicken manure with tree bark for reduced biochar toxicity, enhanced plant growth and reduced stress response in Arabidopsis thaliana** – Submitted to Biochar Journal

WP2 – PROCESSES AND THE END PRODUCTS' ADDED AGRICULTURAL VALUE

Dr. Bart Vandecasteele

Dr. Jarinda Viaene



Viaene et al., 2023. **Screening tests for N sorption allow to select and engineer biochars for N mitigation during biomass processing** - Waste Management

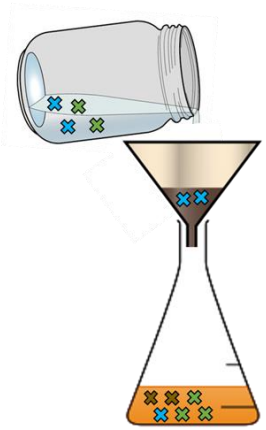
Viaene et al., 2023. **Biochar amendment to cattle slurry reduces NH3 emissions during storage without risk of higher NH3 emissions after soil application of the solid fraction** - Waste Management

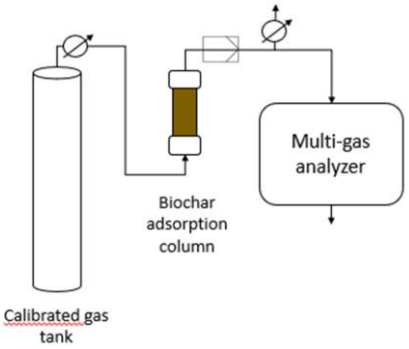
Viaene et al., 2023. **Application of biochar to anaerobic digestion versus digestate: effect on N emissions and C stability** - *Submitted*

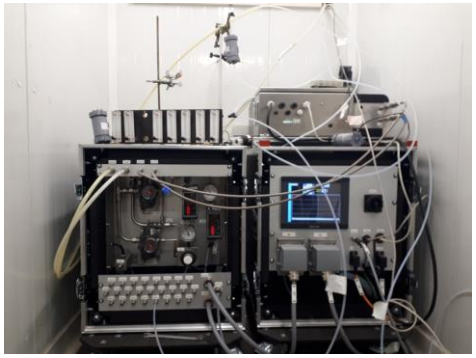
WP2 – PROCESSES AND THE END PRODUCTS' ADDED AGRICULTURAL VALUE

1. Development of fast screening tests for ammonium and ammonia sorption ⇒ selection of biochars with high N sorption capacity for use in biomass processing

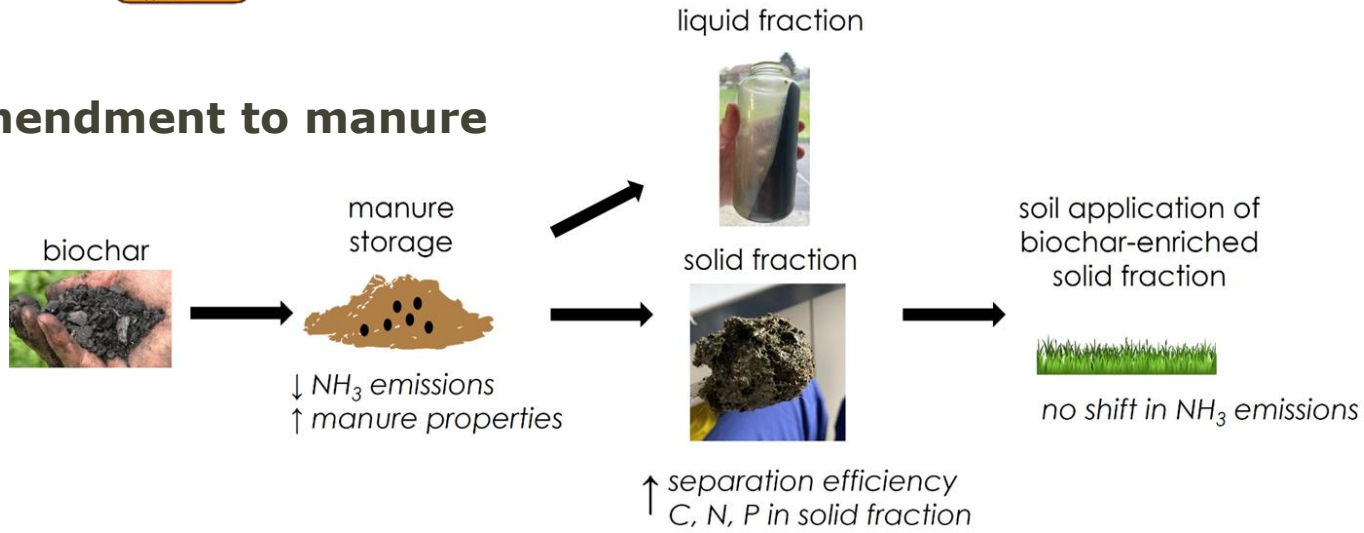
biochar + known nutrient solution
➔ sorption of nutrients onto biochar







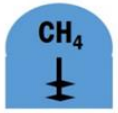
2. Biochar amendment to manure



WP2 – PROCESSES AND THE END PRODUCTS' ADDED AGRICULTURAL VALUE

3. Biochar amendment to anaerobic digestion and digestate

1 Biochar application during anaerobic digestion



↓ NH_3 levels in biogas
NH_4^+-N sorption onto biochar

2 Post-treatment of digestate with biochar

↑ OC and soil improver value of digestates

3 Soil application of biochar-enriched digestates

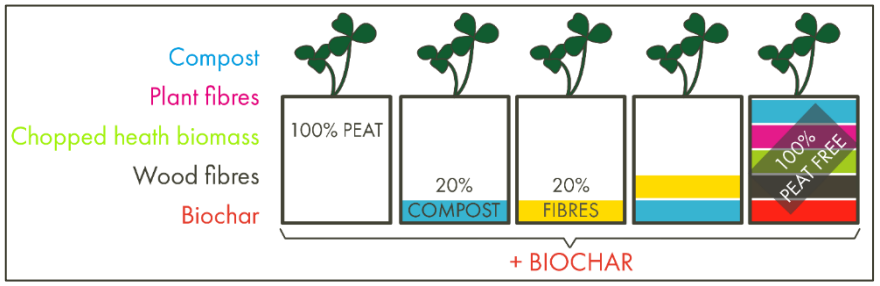
no shift in NH_3 or N_2O emissions
no mineral N release up to 100 days
↓ CO_2 emissions

4. Biochar amendment to cascade with composting

Growing medium + **biochar** → Spent growing medium → Compost / Biochar / Direct reuse as growing medium

Spent growing medium **with biochar**: no decrease in C during cascade, smaller decrease for C:P ratio, higher potential for reuse

WP3 – PEAT ALTERNATIVES FOR GROWING MEDIA



Dr. Jane Debode

Dr. Lisa Joos

De Tender et al., 2021. **Biochar-enhanced resistance to Botrytis cinerea in strawberry fruits (but not leaves) is associated with changes in the rhizosphere microbiome** – Frontiers in Plant Science

Jaiswal **How does biochar influence plant biotic stress?** Book chapter in "Biochar for Environmental Management" (in press)

WP4 – SOILS UNDER PRESSURE FOR OPEN-FIELD CULTIVATION

Prof. Dr. Ann Cuypers

Drs. Ingeborg Pecqueur

PASS2
PLANT ABIOTIC STRESS SIGNALLING & SOLUTIONS

Cuypers et al., 2022. **Method for determining a toxicity and/or growth promotion effect of a treatment or compound** (WO2022167504A1)

Lataf, Pecqueur et al., 2023 **Co-pyrolysis of chicken manure with tree bark for reduced biochar toxicity, enhanced plant growth and reduced stress response in *Arabidopsis thaliana*** – submitted

WP5 – INTEGRATED SUSTAINABILITY ASSESSMENT TOOL

Prof. Dr. Tom Kuppens

Drs. Luca Campion

Prof. Dr. Robert Malina

Drs. Madina Bekchanova

Prof. Dr. Bernard Vanheusden

Drs. Elisa Cavallin

Bekchanova et al., 2021. **Biochar's effect on the ecosystem services provided by sandy-textured and contaminated sandy soils: a systematic review protocol** - Environmental Evidence

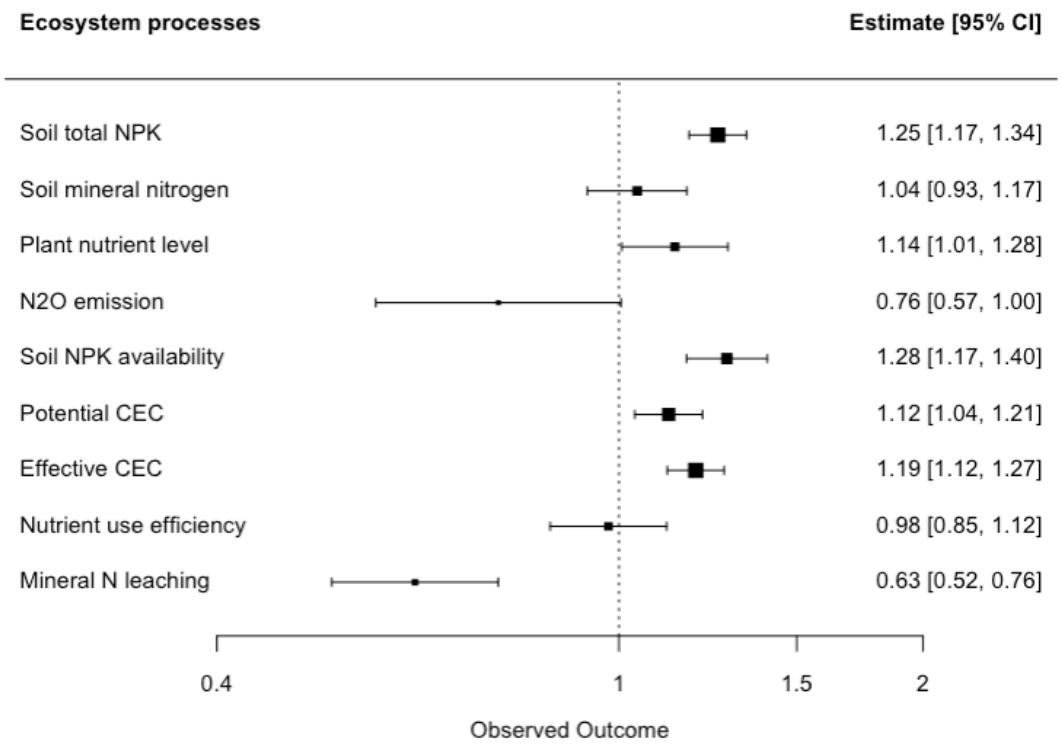
Bekchanova et al., 2024. **Biochar Effects on the Nutrient Cycle in Sandy-textured Soils: A Systematic Review** - submitted to Environmental Evidence

Campion et al., 2023. **The costs and benefits of biochar production and use: A systematic review** - Journal of Cleaner Production

Campion et al., 2024. **Consequential Life Cycle Assessment of Biochar: Comparing Biochar Feedstocks, Temperatures, and Applications** - in preparation

WP5 – INTEGRATED SUSTAINABILITY ASSESSMENT TOOL

Systematic review and meta-analysis
→ Soil processes - outcome

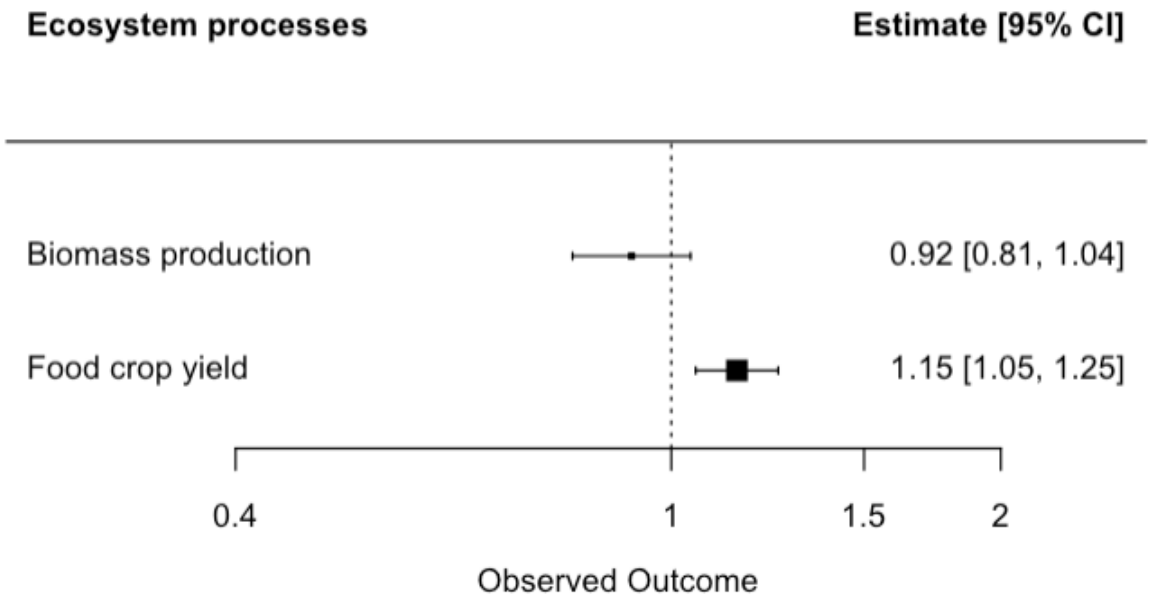


Soil total NPK +25% (+17 to +34)	Soil mineral nitrogen +4% (-7 to +17)
Plant nutrient level +14% (+1 to +28)	N2O emission -24% (-43 to 00)
Soil NPK availability +28% (+17 to +40)	Potential CEC +12% (+4 to +21)
Effective CEC +19% (+12 to +27)	Nutrient use efficiency -2% (-15 to +12)

Mineral N leaching
-37% (-48 to -24)

WP5 – INTEGRATED SUSTAINABILITY ASSESSMENT TOOL

Systematic review and meta-analysis
→ Plant biomass - outcome



Biomass production
-18% (-19 to +4)

Food crop yield
+15% (+5 to +25)

WP5 – INTEGRATED SUSTAINABILITY ASSESSMENT TOOL

Is there a legal framework for biochar in EU and Flanders? And is it **performant** and **suitable** to guarantee **sustainability and climate goals** in the fields of **agriculture** and **circular economy**?

- **Focus** on soil and farming, nature restoration, circular economy

- **Value-chain approach (a framework/relevance for biochar?)**:
  1) **(Pre-)production stage**:
     Input materials (waste and virgin materials) [only EU law]
     Impact assessment [EU and BE law]
     Industrial emissions [EU and BE law]
  2) **Product stage**:
     Legislation on waste (product, by-product, EoW?) [EU and BE law]
     Product legislation (Fertilisers, Organics, Ecolabel, REACH) [only EU law]
  3) **Use stage**:
     Soil protection and *nature restoration** [mainly EU law]
     Nitrates [EU and BE law]
     CAP [only EU law]
     Certification framework for carbon removals [EU]*

* *Analysis of the Proposal as it is an open file*

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Biochar in strawberry cultivation

Dr. Jane Debode

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WP3 – PEAT ALTERNATIVES FOR GROWING MEDIA

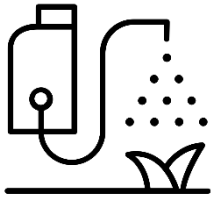
Biochar for strawberry production in growing media

WP3 – PEAT ALTERNATIVES FOR GROWING MEDIA

Challenges for the strawberry production in growing media

Peat replacement by sustainable alternatives

More efficient use of nutrients (reduce input and loses)



Less use of chemical crop protection products (disease suppression)

WP3 – PEAT ALTERNATIVES FOR GROWING MEDIA

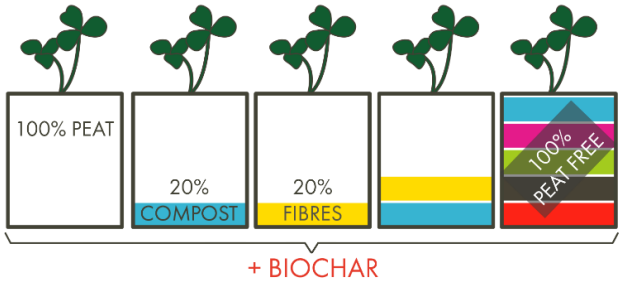
Challenges for the strawberry production in growing media

Peat replacement by sustainable alternatives

More efficient use of nutrients (reduce input and loses)

WP3 – PEAT ALTERNATIVES FOR GROWING MEDIA

From 5% to 100% peat replacement in 4 years time!



Previous research at ILVO:

- peat replacement by **5% biochar** (Amery et al., 2021)
- peat replacement by **10% biochar** in a 40% peat reduced growing medium (Vandecasteele et al., 2023) using renewable and regionally available materials

BASTA:

- peat replacement by **10% biochar** in a 50% peat reduced growing medium
- **10% biochar** in 100% peat replacement => peat-free growing medium

Amery et al. (2021) **Biochar for circular horticulture: Feedstock related effects in soilless cultivation**. Agronomy, 11, 629.

Vandecasteele et al. (2023) **Towards environmentally sustainable growing media for strawberry cultivation: Effect of biochar and fertigation on circular use of nutrients**. Agricultural Water Management, 284, 108361.

WP3 – PEAT ALTERNATIVES FOR GROWING MEDIA

Growing medium	Composition (vol%)					
	Peat	Wood fiber	Woody green compost	Bark compost	Acidified soft rush straw/ Grass fiber	Woody biochar
Peat reduced	50	25	25	0	0	0
Peat reduced with 10% biochar	40	25	25	0	0	10
Peatfree	0	25	25	30	20	0
Peatfree with 10% biochar	0	30	25	20	15	10

WP3 – PEAT ALTERNATIVES FOR GROWING MEDIA

Peat

WP3 – PEAT ALTERNATIVES FOR GROWING MEDIA

Wood fiber

WP3 – PEAT ALTERNATIVES FOR GROWING MEDIA

Woody green compost

WP3 – PEAT ALTERNATIVES FOR GROWING MEDIA

Bark compost

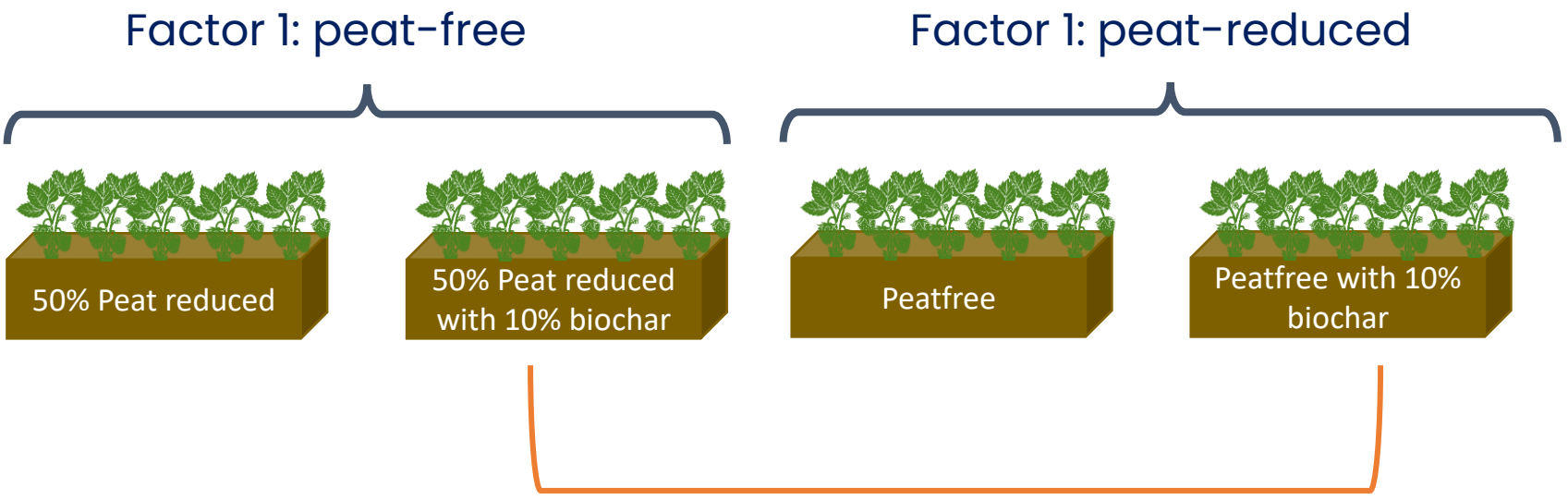
WP3 – PEAT ALTERNATIVES FOR GROWING MEDIA

Acidified soft rush straw

WP3 – PEAT ALTERNATIVES FOR GROWING MEDIA

Woody biochar

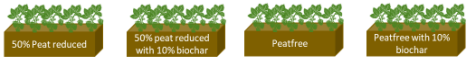
WP3 – PEAT ALTERNATIVES FOR GROWING MEDIA



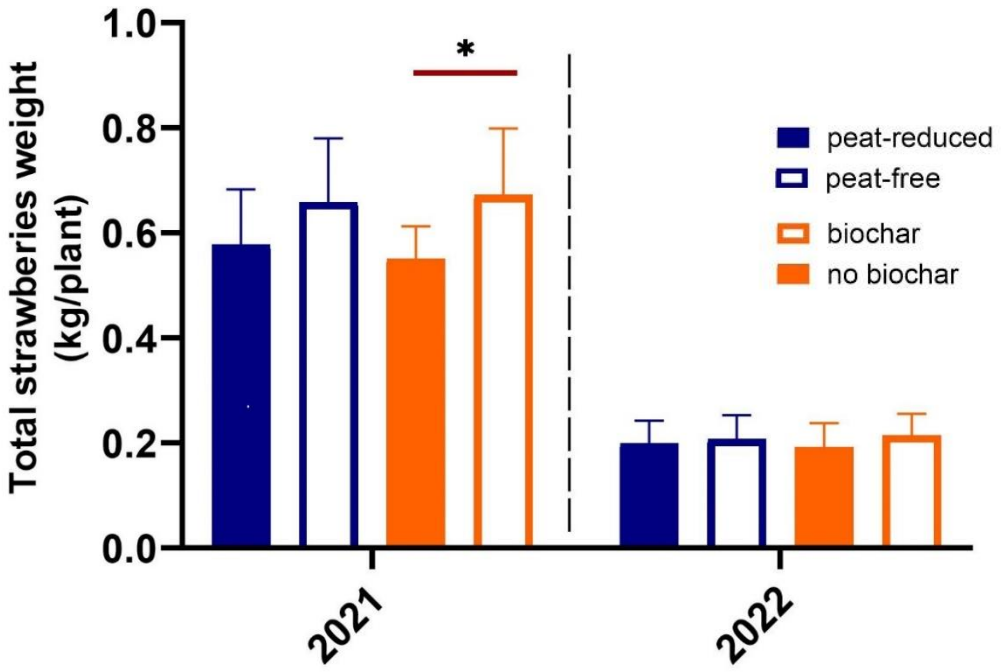
3 trays – 15 strawberry plants per tray

Factor 1: peat-free vs. peat-reduced (peat)
Factor 2: with or without biochar (biochar)

WP3 – PEAT ALTERNATIVES FOR GROWING MEDIA



Factor 1: peat-free vs. peat-reduced (peat)
Factor 2: with or without biochar (biochar)



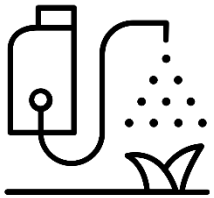
WP3 – PEAT ALTERNATIVES FOR GROWING MEDIA

- Peat replacement with 10% biochar successful in peat reduced and peatfree growing media => future research >10% biochar?

- Biochar used for this should be from woody/nutrient poor feedstock

- The renewable materials biochar, grass fiber and woody compost have potential to replace fertilizers

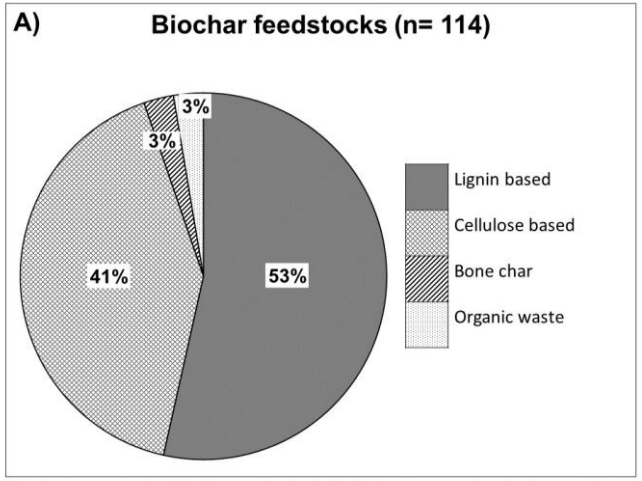
Challenges for the strawberry production in growing media

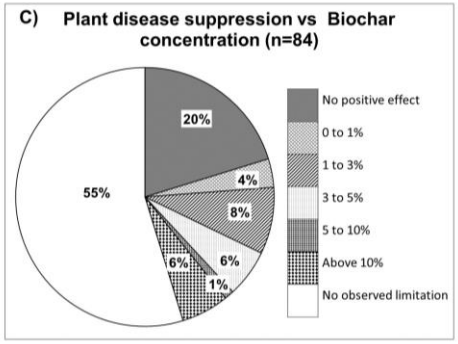


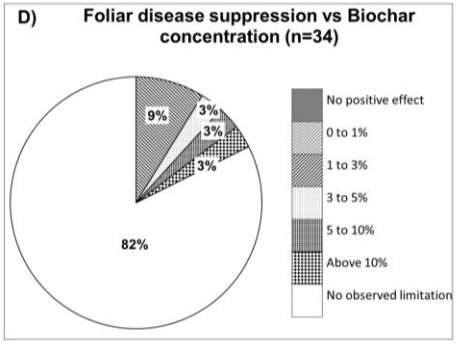
Less use of chemical crop protection products (disease suppression)

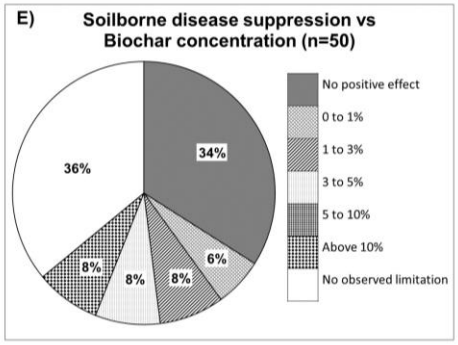
Review paper on use of biochar against biotic stress

- In peat or mineral soil
- Biochar from nutrient poor feedstock
- Low doses use, especially for soilborne/root diseases





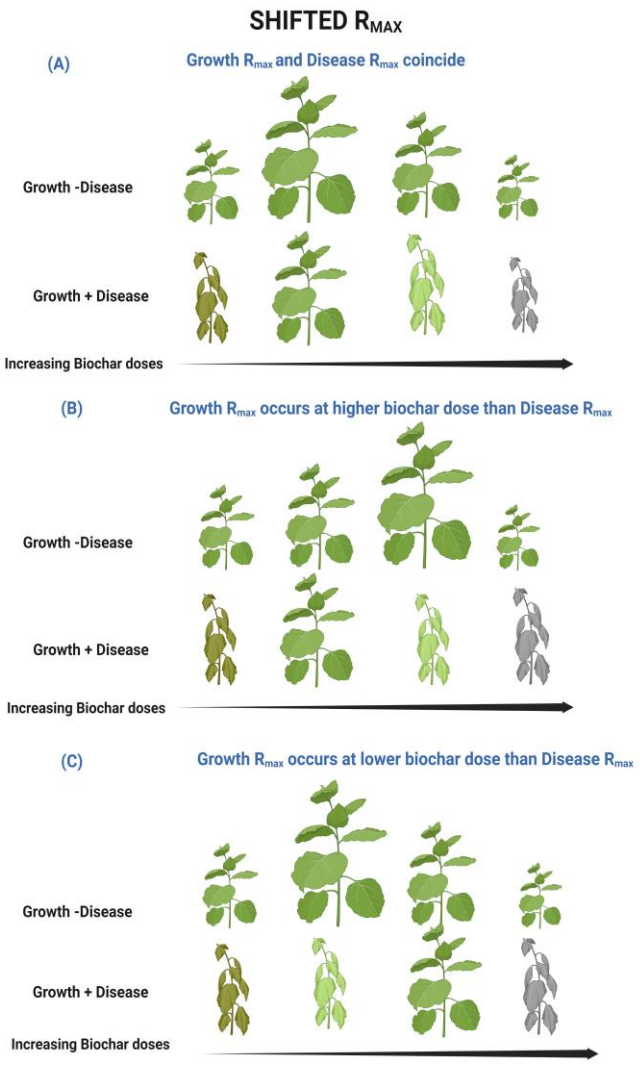




Jaiswal et al. (in press). How does biochar influence plant biotic stress? Book chapter in **"Biochar for Environmental Management"**

WP3 – PEAT ALTERNATIVES FOR GROWING MEDIA

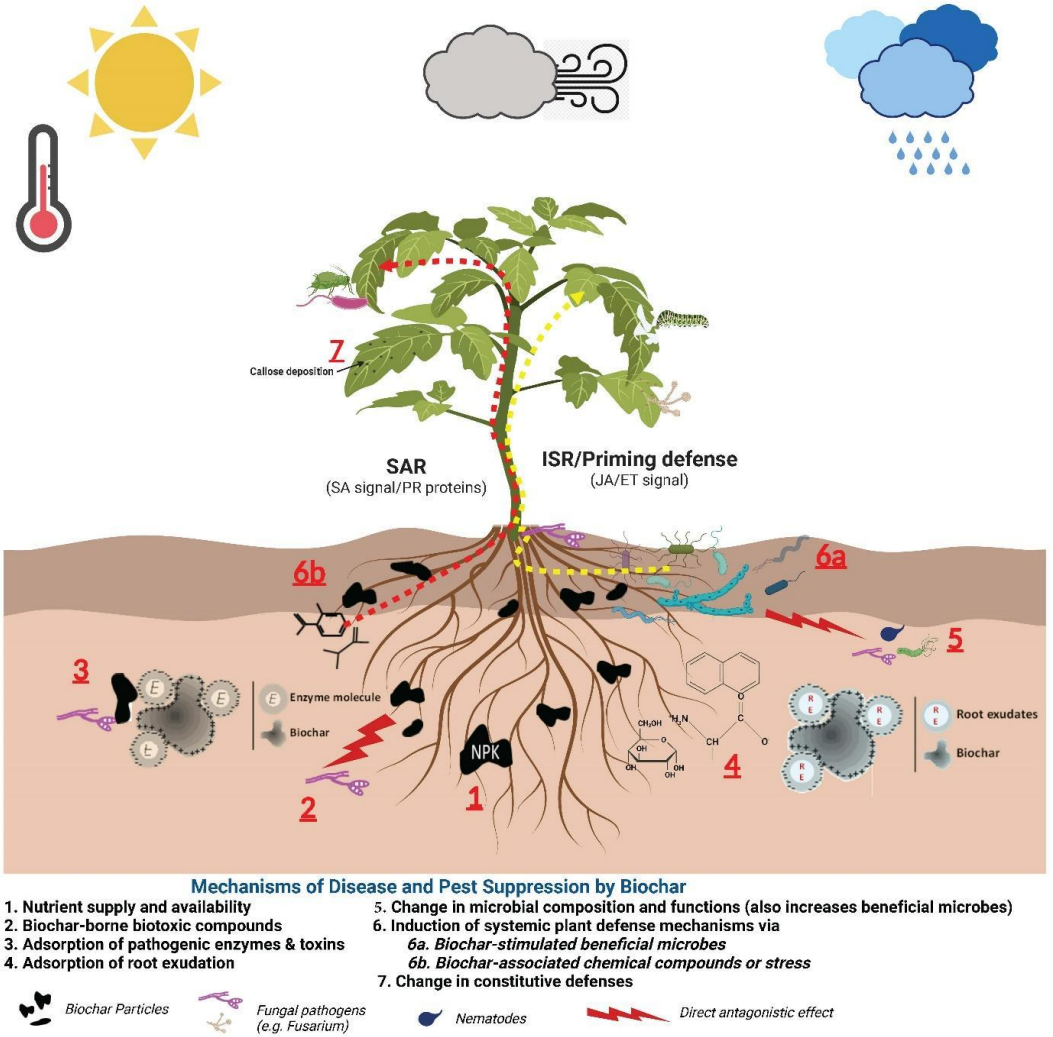
- Growth versus disease
- Dose matters (for root diseases)!



Jaiswal (in press). How does biochar influence plant biotic stress? Book chapter in **"Biochar for Environmental Management"**

WP3 – PEAT ALTERNATIVES FOR GROWING MEDIA

Main mechanism = "vaccine" via shift in the rhizosphere microbiome



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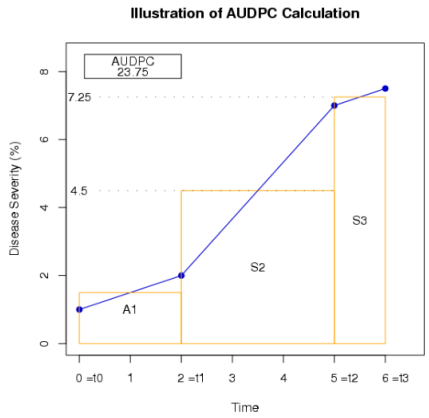
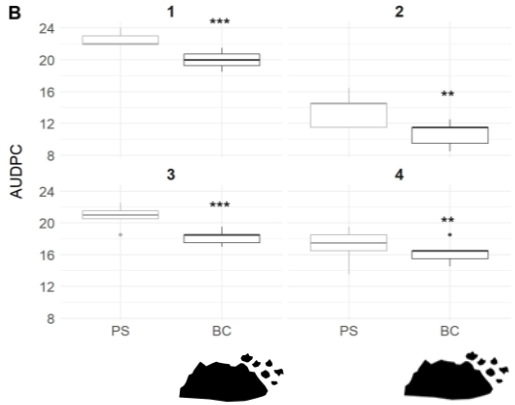
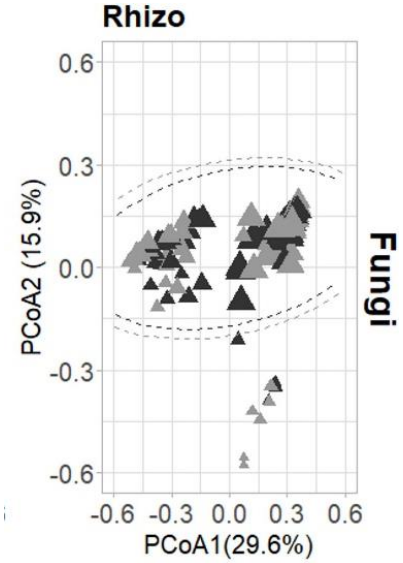
WP3 – PEAT ALTERNATIVES FOR GROWING MEDIA





- Nutrient poor biochar (woody feedstock)
- In peat
- Low dose ≤3%
- Above ground pathogen (*Botrytis cinerea*)
- Shift in the fungal microbiome



De Tender et al. (2021). **Biochar-enhanced resistance to Botrytis cinerea in strawberry fruits (but not leaves) is associated with changes in the rhizosphere microbiome**. Frontiers in Plant Science, 12, 700479.

WP3 – PEAT ALTERNATIVES FOR GROWING MEDIA

Previous research at ILVO

- ☐ Biochar in peat at low dose ≤3
- ☐ Biochar from woody feedstock (nutrient low)
- ☐ Fruit disease ↓

BASTA:

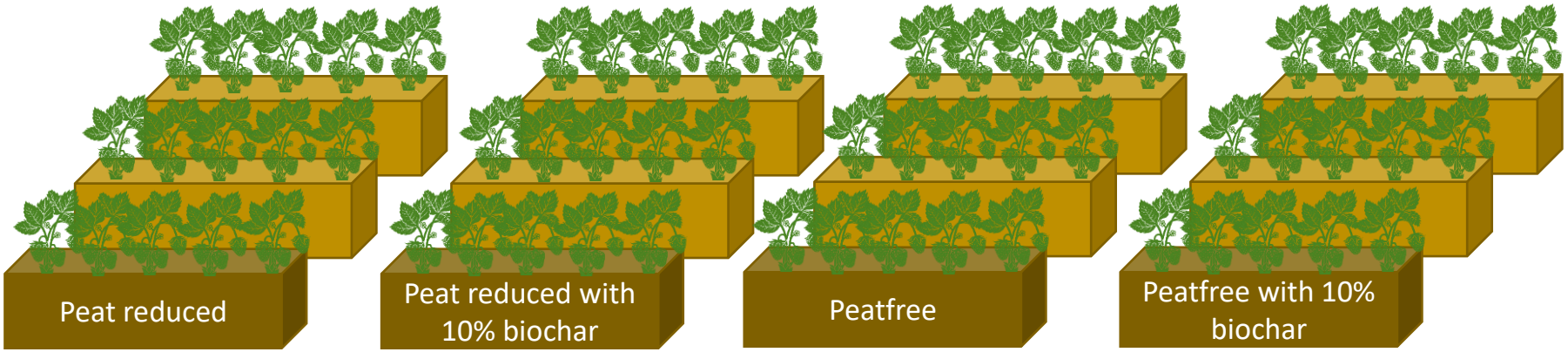
- ☐ 10% bulk biochar in peat reduced or peat free
- ☐ Low dose <3% biochar from manure feedstock (nutrient high)
- ☐ Root pathogen *Phytophthora cactorum*

De Tender et al. (2021). **Biochar-enhanced resistance to Botrytis cinerea in strawberry fruits (but not leaves) is associated with changes in the rhizosphere microbiome**. Frontiers in Plant Science, 12, 700479.

WP3 – PEAT ALTERNATIVES FOR GROWING MEDIA

3 trays – 15 strawberry plants per tray

- 2 *Phytophthora cactorum* (root rot)
- 1 without *Phytophthora cactorum*

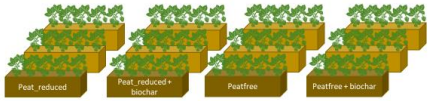


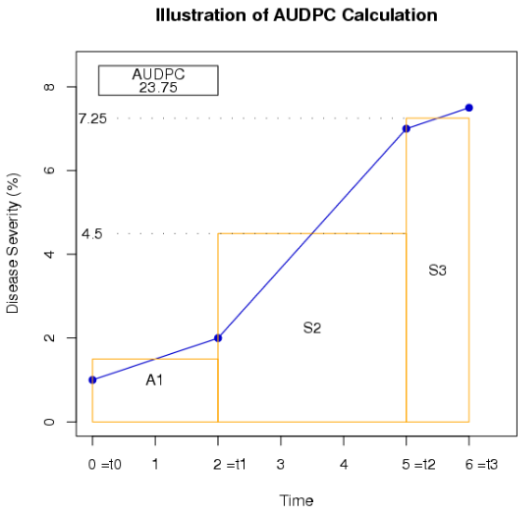
3x vaccine

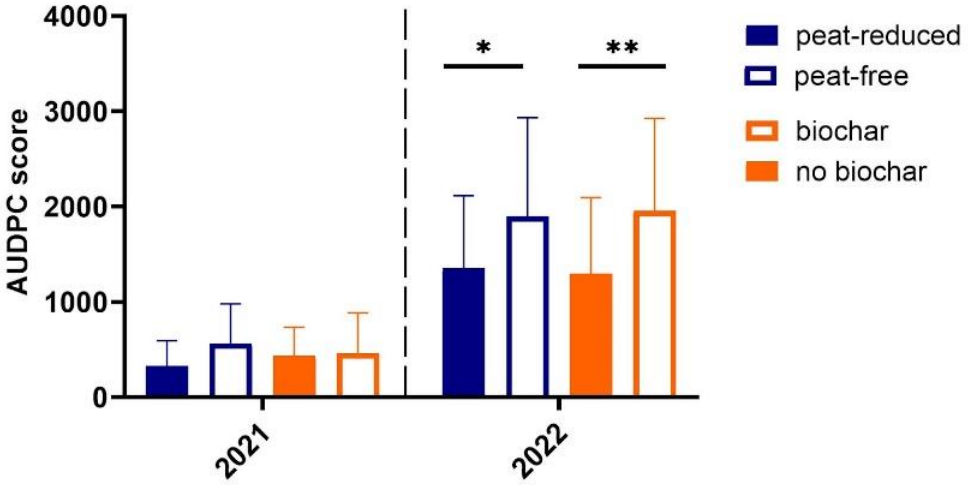
None

x 4

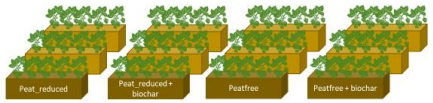
WP3 – PEAT ALTERNATIVES FOR GROWING MEDIA





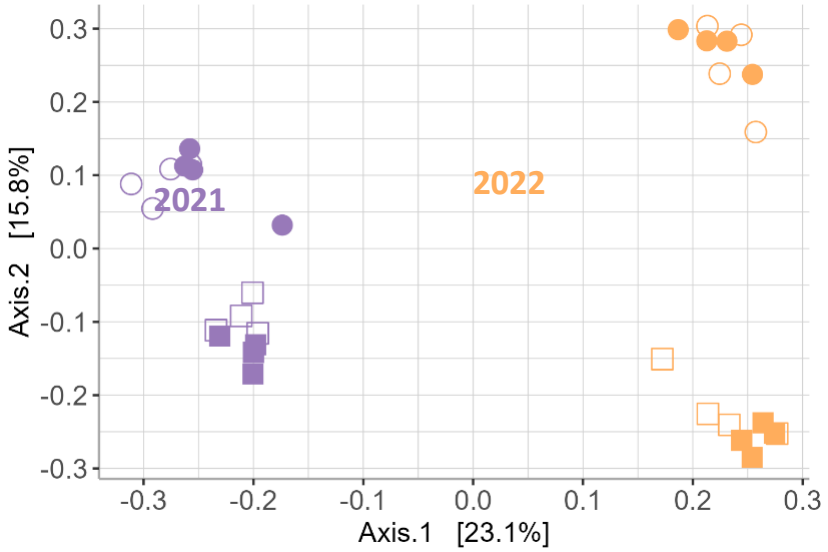


WP3 – PEAT ALTERNATIVES FOR GROWING MEDIA



Rhizosphere microbiome: year (2021/2022) > peat (yes/no) > bulk biochar (yes/no)

Bacteria



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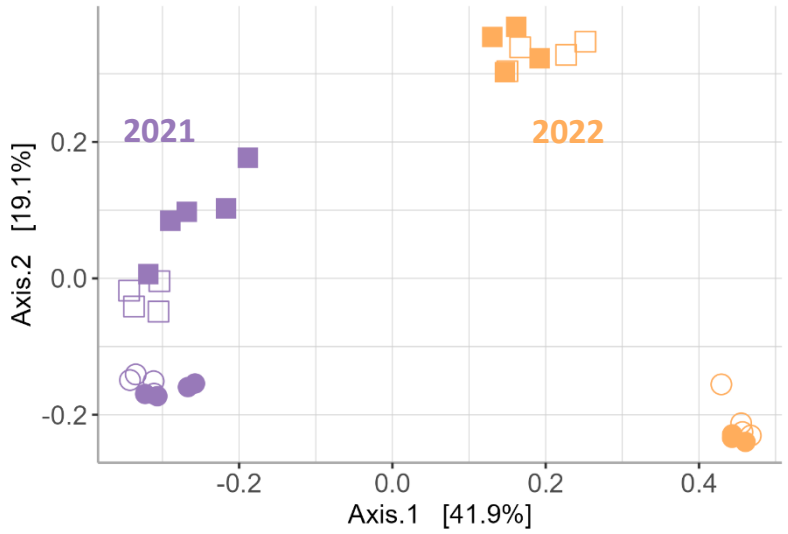
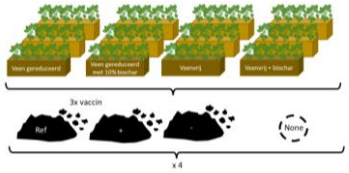
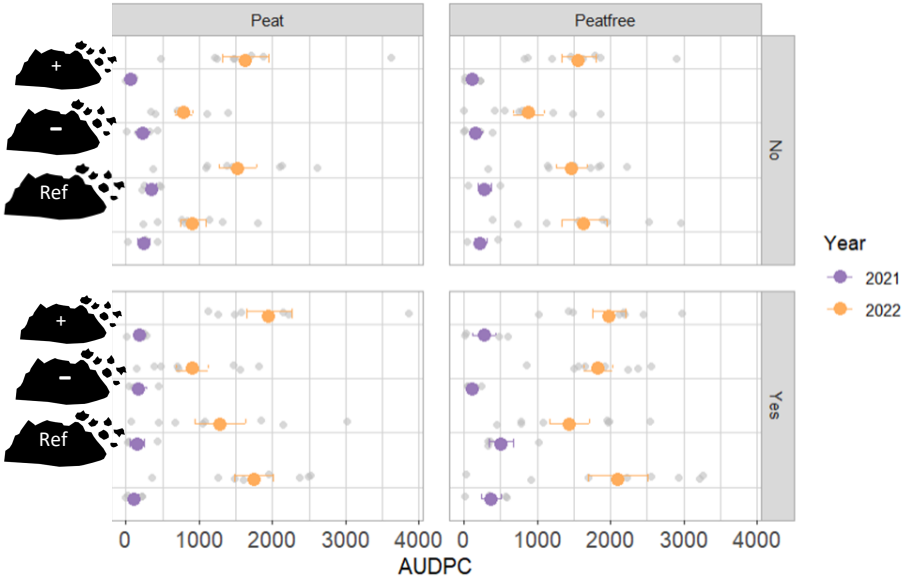


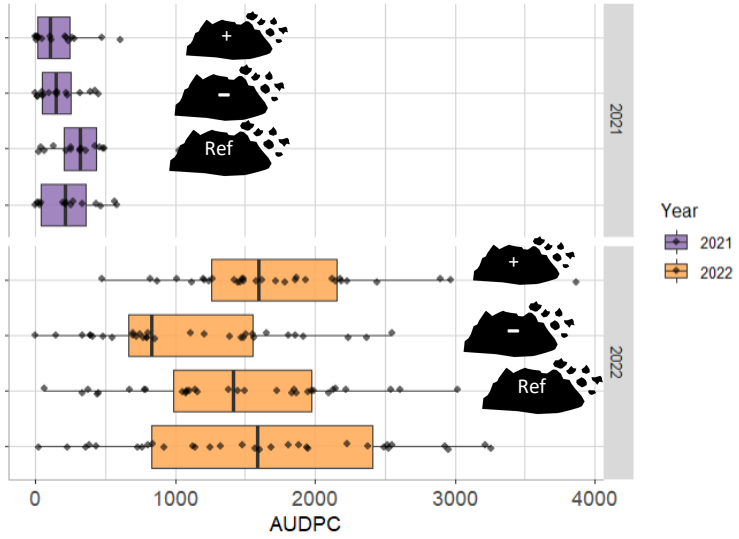
■ Peat □ Peat with biochar

● Peat-free ○ Peat-free with biochar

WP3 – PEAT ALTERNATIVES FOR GROWING MEDIA





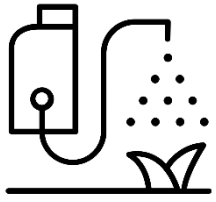


- **Biochar vaccine 2021**
  manure biochar: ↓ root rot
- **Biochar vaccine 2022**
  woody biochar: ↓ root rot

WP3 – PEAT ALTERNATIVES FOR GROWING MEDIA

Biochar from nutrient low feedstock can be used for peat replacement in peat reduced and peat free growing media

100% peat replacement by renewable and regionally available materials, including plant fibers after acidification



Disease suppression by biochar for root diseases is

- year dependent
- dose dependent => peat replacement (high dose needed) conflicts with disease suppression (low dose needed)

Disease suppression by biochar for fruit diseases is less dose dependent

THANK YOU

ILVO

CMK CENTRE FOR ENVIRONMENTAL SCIENCES UHASSELT 25 YEARS

pcfruit PROEFCENTRUM FRUITTEELT VZW

Volcani International Partnerships

Bart Vandecasteele
Lisa Joos
Jarinda Viaene
Kristof Maenhout
Sarah Ommeslag
Caroline De Tender

An Cuypers
Marijke Jozefczak
Michiel Huybrechts
Ingeborg Pecqueur

Wendy Van Hemelrijck
An Ceustermans
Miet Boonen

Amit Jaiswal
Omer Frenkel
Ellen Graber

BASTA

CMK CENTRUM VOOR MILIEUKUNDE UHASSELT

ILVO Instituut voor Landbouw-, Visserij- en Voedingsonderzoek

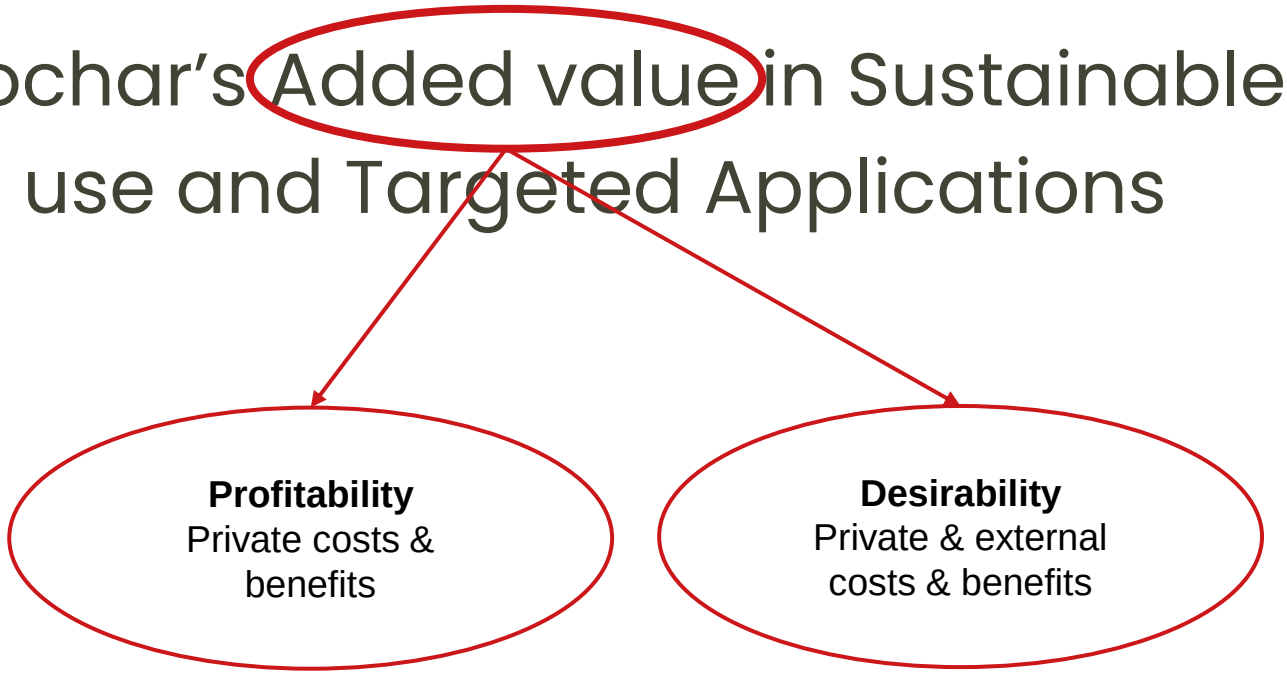
The added value of biochar

Drs. Luca Campion

fwo Research Foundation Flanders
Opening new horizons

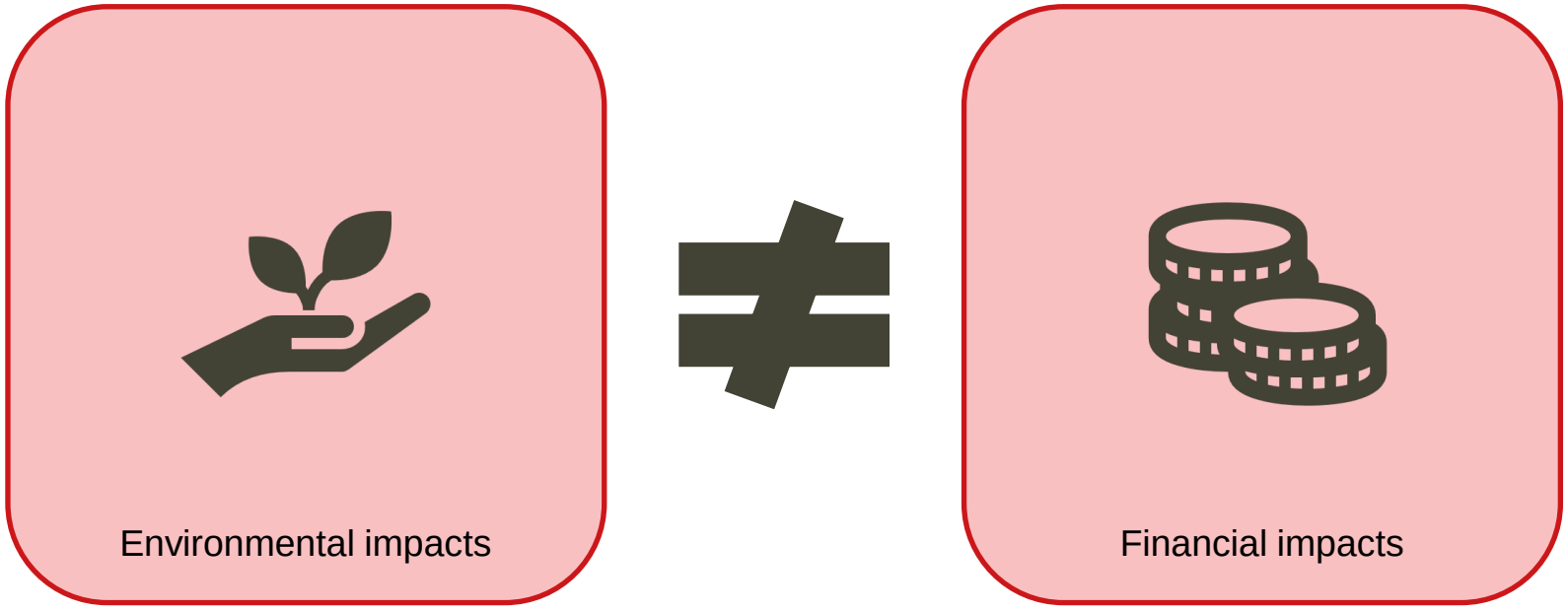
Background

BASTA = Biochar's Added value in Sustainable land use and Targeted Applications



Background

- Why distinguish between profitability and desirability?



Background

- Why distinguish between profitability and desirability?

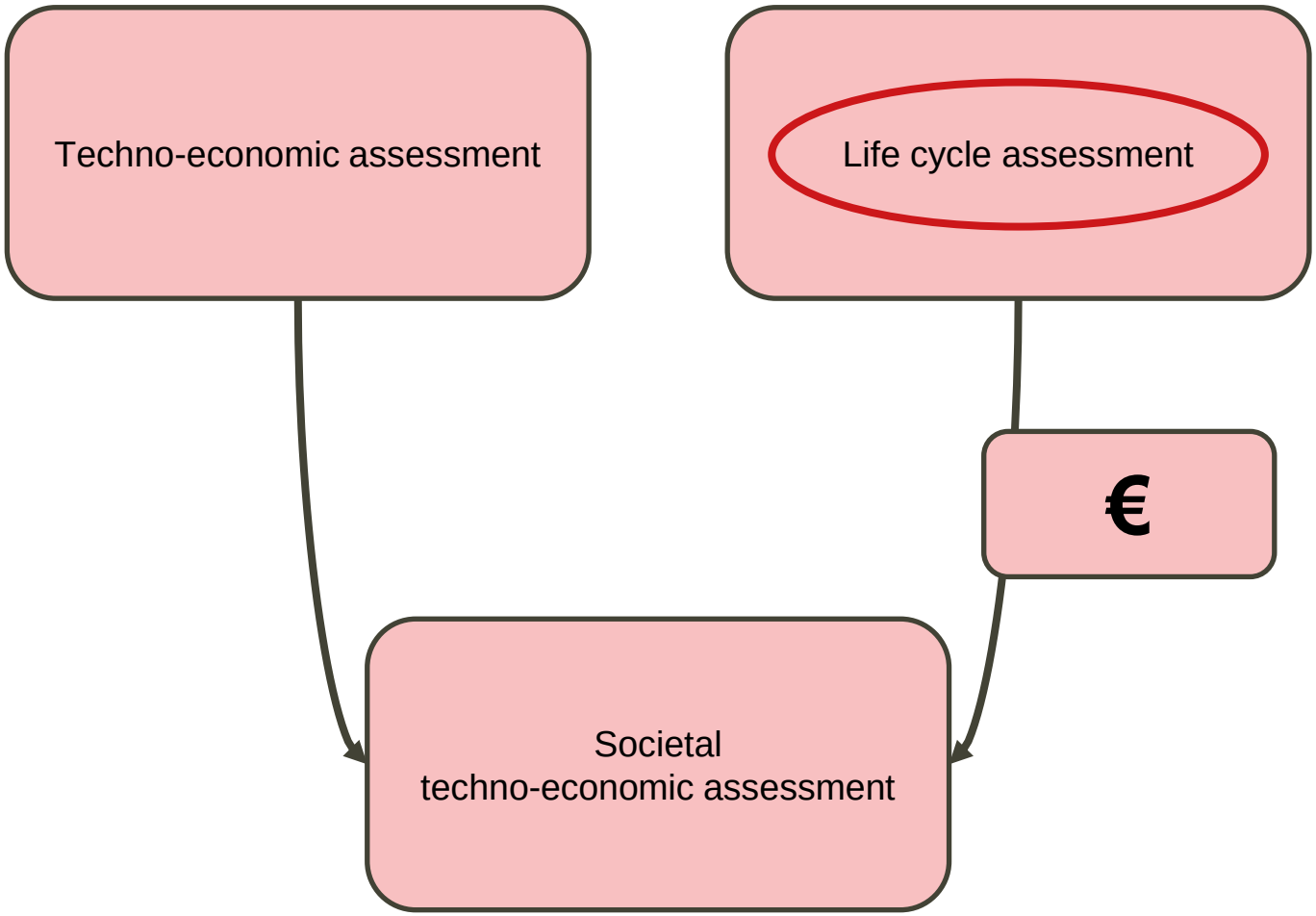
- Maybe, even though biochar is beneficial to society (i.e., it is desirable), there is no incentive for businesses to produce it (i.e., it is not profitable)?

Background

- We investigate the difference between private and societal value using a **societal techno-economic assessment**.

- Integration of environmental effects in a classic techno-economic assessment through their monetization.

Background


Techno-economic assessment
Life cycle assessment
€
Societal
techno-economic assessment

Life cycle assessment

- 2 biochar feedstocks: wood vs. manure
- 2 pyrolysis temperatures:
  450°C vs. 600°C
- 2 biochar applications:
  direct use vs. cascading use

⇨ **8 scenarios**

Life cycle assessment

Biomass

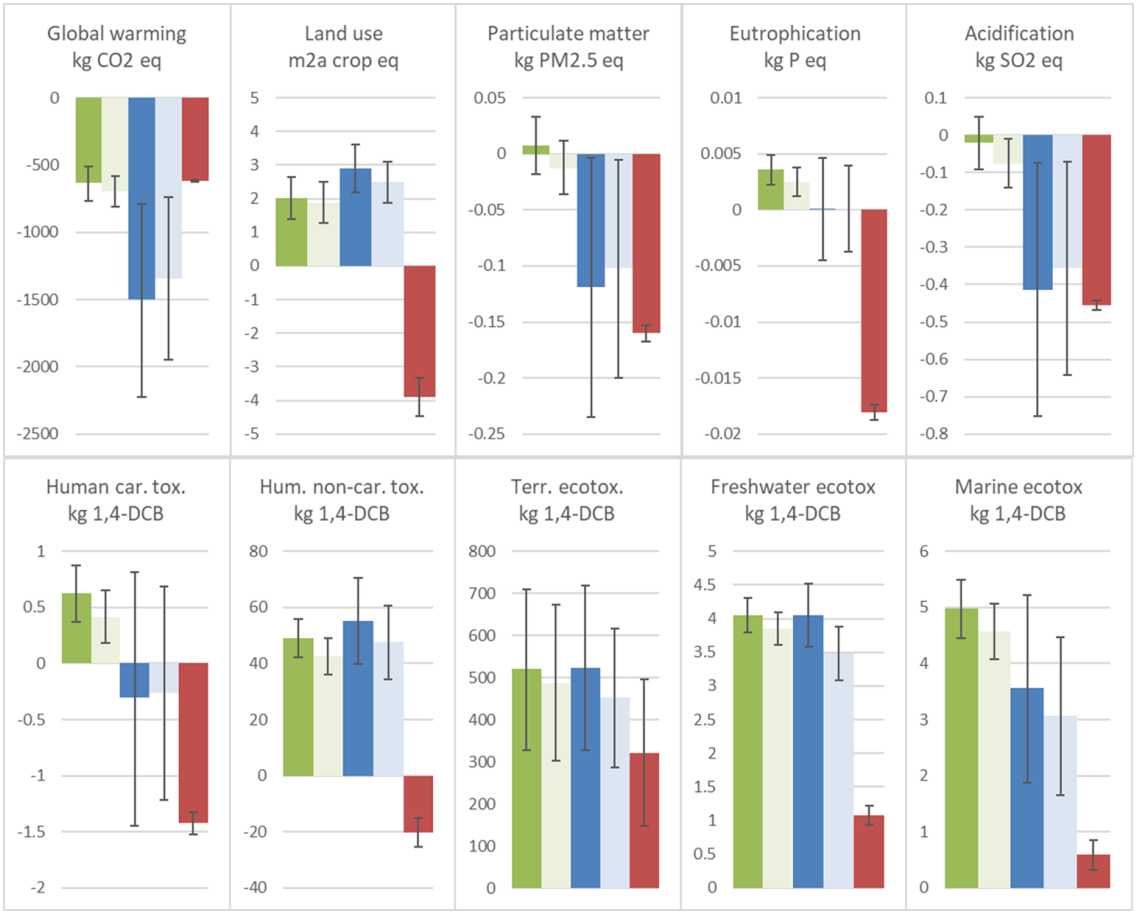
PYROd

PYROc

Life cycle assessment

Results for woody biochar

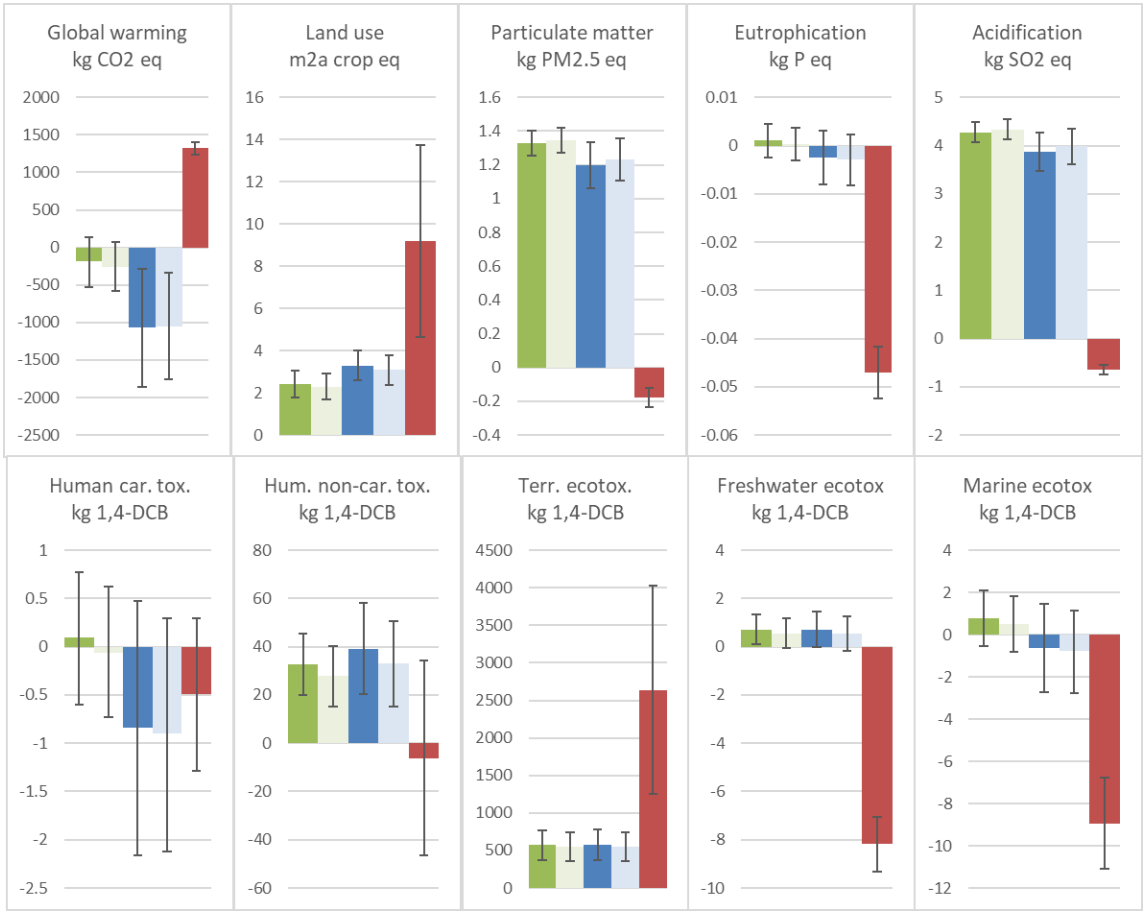
- PYROd (450°C)
- PYROd (600°C)
- PYROc (450°C)
- PYROc (600°C)
- Reference



Life cycle assessment

Results for manure-based biochar

- PYROd (450°C)
- PYROd (600°C)
- PYROc (450°C)
- PYROc (600°C)
- Reference



Life cycle assessment

Conclusions:

- Biochar does what it is supposed to, namely mitigate climate change
  - However, when using the woody feedstock, a cascading use of the biochar is required

- For other impact categories, both biochar feedstocks tend to perform slightly worse than the reference system
  - However, what is the relative importance of these impact categories?

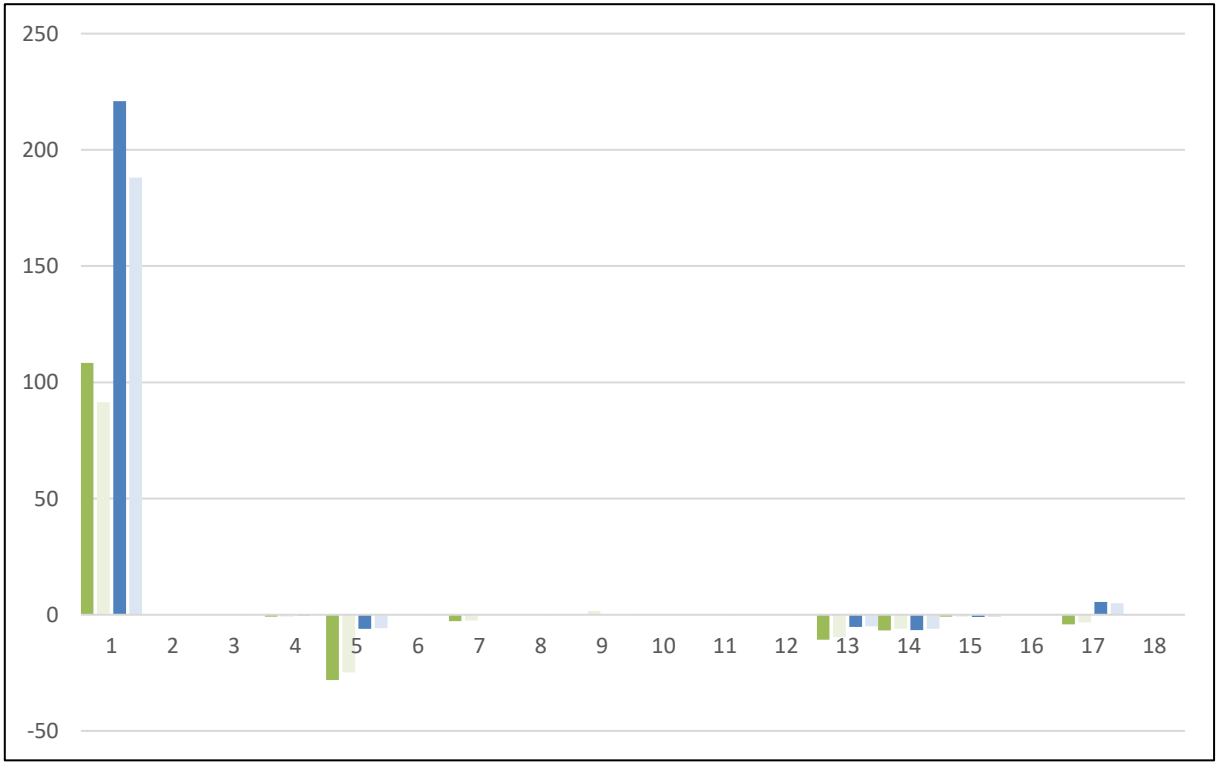
Monetization

Impact category	Unit	Low price (€)	Medium price (€)	High price (€)
Global warming	kg CO2 eq	0.05	0.13	0.16
Stratospheric ozone depletion	kg CFC11 eq	15.2	29.1	69.6
Ionizing radiation	kBq Co-60 eq	0.00275	0.00422	0.00594
Ozone formation, Human health	kg NOx eq	0.99	1.7	2.21
Fine particulate matter formation	kg PM2.5 eq	101.2	168	235
Ozone formation, Terrestrial ecosystems	kg NOx eq	0.043	0.043	0.153
Terrestrial acidification	kg SO2 eq	3.38	6.46	10.72
Freshwater eutrophication	kg P eq	2.56	5.53	10.13
Marine eutrophication	kg N eq	7.64	14.25	27.6
Terrestrial ecotoxicity	kg 1,4-DCB	0.00067	0.00095	0.00123
Freshwater ecotoxicity	kg 1,4-DCB	0.0218	0.0309	0.04
Marine ecotoxicity	kg 1,4-DCB	0.0033	0.0047	0.006
Human carcinogenic toxicity	kg 1,4-DCB	3.55	5.25	7.91
Human non-carcinogenic toxicity	kg 1,4-DCB	0.066	0.097	0.146
Land use	m2a crop eq	0.103	0.146	0.189
Mineral resource scarcity	kg Cu eq	0	0.014	0.0826
Fossil resource scarcity	kg oil eq	0	0.028	0.163
Water consumption	m3	0	0.137	0.181

Monetization

Results for woody biochar

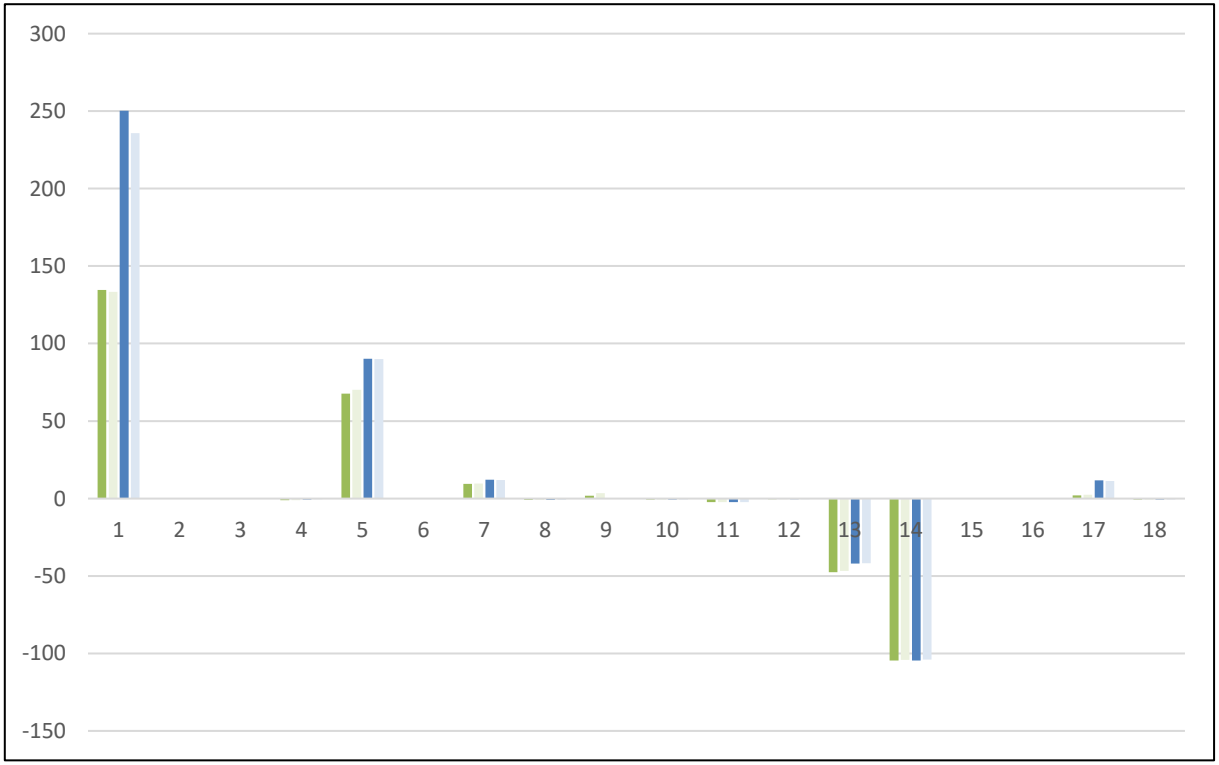
PYROd (450°C)
PYROd (600°C)
PYROc (450°C)
PYROc (600°C)



Monetization

Results for manure-based biochar

PYROd (450°C)
PYROd (600°C)
PYROc (450°C)
PYROc (600°C)



Societal TEA

Main assumptions:

- Feed rate: 3 000 kg/hr
  - This would mean 1 plant in Flanders
- 13 employees, from manager to operators
- Syngas used to power pyrolysis and produce electricity
- Biochar sold in bulk

Societal TEA

NPV analysis

- Wood-based biochar

	Private			Societal		
Biochar price	**450°C**	**600°C**	**450°C PYROd**	**600°C PYROd**	**450°C PYROc**	**600°C PYROc**
0	€ -32,909,455.61	€ -33,240,253.33	€ -20,991,931.89	€ -22,880,099.24	€ 59,362,567.97	€ 45,066,019.69
500	€ 13,979,942.23	€ 8,010,128.48	€ 25,897,465.95	€ 18,370,282.57	€ 106,251,965.82	€ 86,316,401.50
1000	€ 54,534,533.58	€ 42,843,004.37	€ 66,452,057.30	€ 53,203,158.46	€ 146,806,557.17	€ 121,149,277.39

- Manure-based biochar (pellets)

	Private			Societal		
Biochar price	**450°C**	**600°C**	**450°C PYROd**	**600°C PYROd**	**450°C PYROc**	**600°C PYROc**
0	€ -143,643,596.99	€ -144,001,046.18	€ -126,226,726.59	€ -122,840,806.44	€ -44,972,766.92	€ -52,189,516.25
500	€ -88,243,473.63	€ -95,057,182.83	€ -70,826,603.22	€ -73,896,943.09	€ 10,427,356.45	€ -3,245,652.90
1000	€ -32,843,350.26	€ -46,113,319.48	€ -15,426,479.86	€ -24,953,079.74	€ 65,827,479.81	€ 45,698,210.45

Societal TEA

NPV analysis

- Wood-based biochar

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Biochar price	**450°C**	**600°C**	**450°C PYROd**	**600°C PYROd**	**450°C PYROc**	**600°C PYROc**
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- Manure-based biochar (raw)

	Private			Societal		
Biochar price	**450°C**	**600°C**	**450°C PYROd**	**600°C PYROd**	**450°C PYROc**	**600°C PYROc**
0	€ -32,817,576.77	€ -33,175,025.96	€ -15,400,706.37	€ -12,014,786.22	€ 65,853,253.30	€ 58,636,503.97
500	€ 15,069,254.62	€ 9,958,972.72	€ 32,486,125.03	€ 31,119,212.46	€ 113,740,084.70	€ 101,770,502.65
1000	€ 56,619,347.15	€ 46,666,870.23	€ 74,036,217.55	€ 67,827,109.97	€ 155,290,177.22	€ 138,478,400.16

Societal TEA

Minimum selling price of biochar

- Wood-based biochar

	Private		Societal			
Externalities	**450°C**	**600°C**	**450°C PYROd**	**600°C PYROd**	**450°C PYROc**	**600°C PYROc**
Low			€ 286.21	€ 347.25	€ 80.51	€ 139.99
Medium	€ 327.64	€ 385.02	€ 138.02	€ 196.40	€ -337.58	€ -273.25
High			€ 194.11	€ 246.32	€ -548.91	€ -485.17

- Manure-based biochar (pellets)

	Private		Societal			
Externalities	**450°C**	**600°C**	**450°C PYROd**	**600°C PYROd**	**450°C PYROc**	**600°C PYROc**
Low			€ 1,353.77	€ 1,522.39	€ 1,132.47	€ 1,303.58
Medium	€ 1,318.89	€ 1,496.52	€ 1,124.35	€ 1,258.51	€ 653.21	€ 793.35
High			€ 1,139.23	€ 1,254.92	€ 405.89	€ 533.16

Societal TEA

Minimum selling price of biochar

- Wood-based biochar

	Private		Societal			
Externalities	**450°C**	**600°C**	**450°C PYROd**	**600°C PYROd**	**450°C PYROc**	**600°C PYROc**
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- Manure-based biochar (raw)

	Private		Societal			
Externalities	**450°C**	**600°C**	**450°C PYROd**	**600°C PYROd**	**450°C PYROc**	**600°C PYROc**
Low			€ 353.54	€ 390.21	€ 132.24	€ 171.40
Medium	€ 318.66	€ 364.35	€ 124.12	€ 126.34	- € 347.02	- € 338.83
High			€ 139.00	€ 122.74	- € 594.34	- € 599.02

Conclusions

- A 3 000 kg/hr plant in Flanders shows potential for profitability – under the right circumstances.
- The external benefits outweigh the external costs, so there is a potential for desirability.
- Biochar production provides value to society.
  - The value depends on the specific scenario considered.

Biochar's Flemish policy

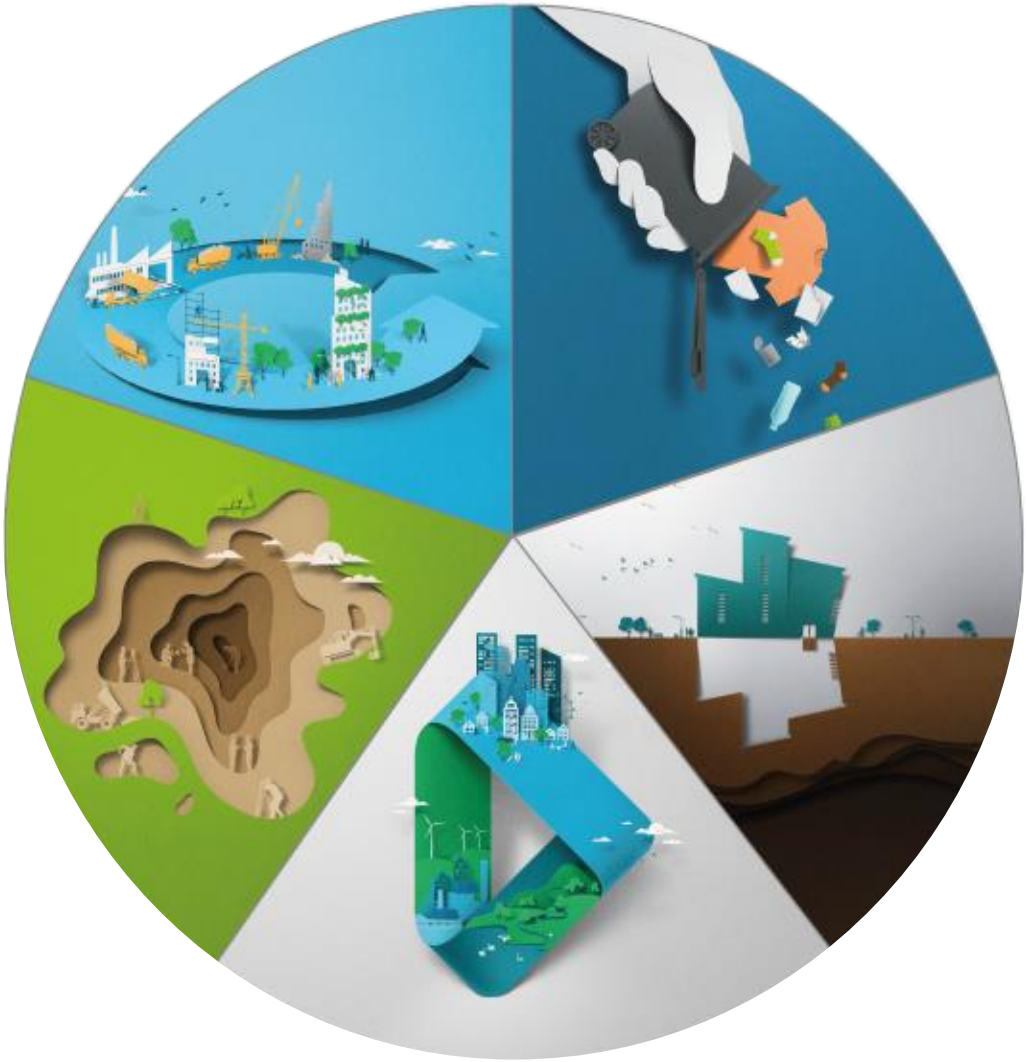
Katleen Van den Eynden (OVAM)

SAMEN MAKEN WE MORGEN MOOIER

OVAM

Research Foundation Flanders
Opening new horizons

Biochar – Vlaams beleid



Vlaanderen
is materiaalbewust

SAMEN MAKEN WE
MORGEN MOOIER
OVAM

Inhoud

- Wat is biochar?
- Pyrolyse van biomassa
- Waar staat biochar in ons afvalstoffenbeleid
- Het gebruik van biochar als BVM
- Bespreken van voorbeelden

Inhoud

- **Wat is biochar?**
- Pyrolyse van biomassa
- Waar staat biochar in ons afvalstoffenbeleid
- Het gebruik van biochar als BVM
- Bespreken van voorbeelden

Wat is biochar?

- Letterlijk vertaald BIOKOOL
- Het verkolen van biomassa
- Biomassa dus niet enkel hout(afval)

- Meer dan 1500 jaar geleden werd biochar gebruikt in de landbouw in het Amazonewoud

Terra Preta do India

Vlaanderen
is materiaalbewust

SAMEN MAKEN WE MORGEN MOOIER
OVAM

Wat is biochar?

- **Sinds eind jaren 2000 een grote interesse in het gebruik van biochar als bodemverbeterend middel (BVM), claims voor:**
  - positieve effecten op bodemvruchtbaarheid
  - positieve klimaateffecten, vb een koolstofbuffer
- **Ook in Vlaanderen hoge interesse door het laag organisch stofgehalte in onze landbouwbodems**
- **OVAM**
  - Meer en meer vragen rond pyrolyseren van biomassa(rest)stromen tot biochar
    - Verschillende inputstromen
    - Verschillende toepassingen (BVM, brandstof, reductans, actief kool, …)

Inhoud

- Wat is biochar?
- **Pyrolyse van biomassa**
- Waar staat biochar in ons afvalstoffenbeleid
- Het gebruik van biochar als BVM
- Bespreken van voorbeelden

Pyrolyse van biomassa

- **Niet ingaan op technische aspecten**
- **Maar de ene biochar is de andere niet**
  - Inputmateriaal
  - Temperatuur
  - Reactiesnelheid
  - Activeren van biokool
  - ….

Pyrolyse van biomassa

- **Installaties voor de productie van biochar**
  - Meestal vergund onder de rubriek voor afvalverbranding

Def. Verbrandingsinstallatie:

"verbrandingsinstallatie": een vaste of mobiele technische eenheid of inrichting die specifiek bestemd is voor de thermische behandeling van afval, al dan niet met terugwinning van de geproduceerde verbrandingswarmte. Dit bevat onder meer de verbranding door oxidatie van afval alsmede andere thermische behandelingsprocessen zoals pyrolyse, vergassing en plasmaproces, voorzover de producten van de behandeling vervolgens worden verbrand.

Inhoud

- Wat is biochar?
- Pyrolyse van biomassa
- **Waar staat biochar in ons afvalstoffenbeleid**
- Het gebruik van biochar als BVM
- Bespreken van voorbeelden

Hoe gaan we met biochar om binnen het afval- en materialenbeleid?

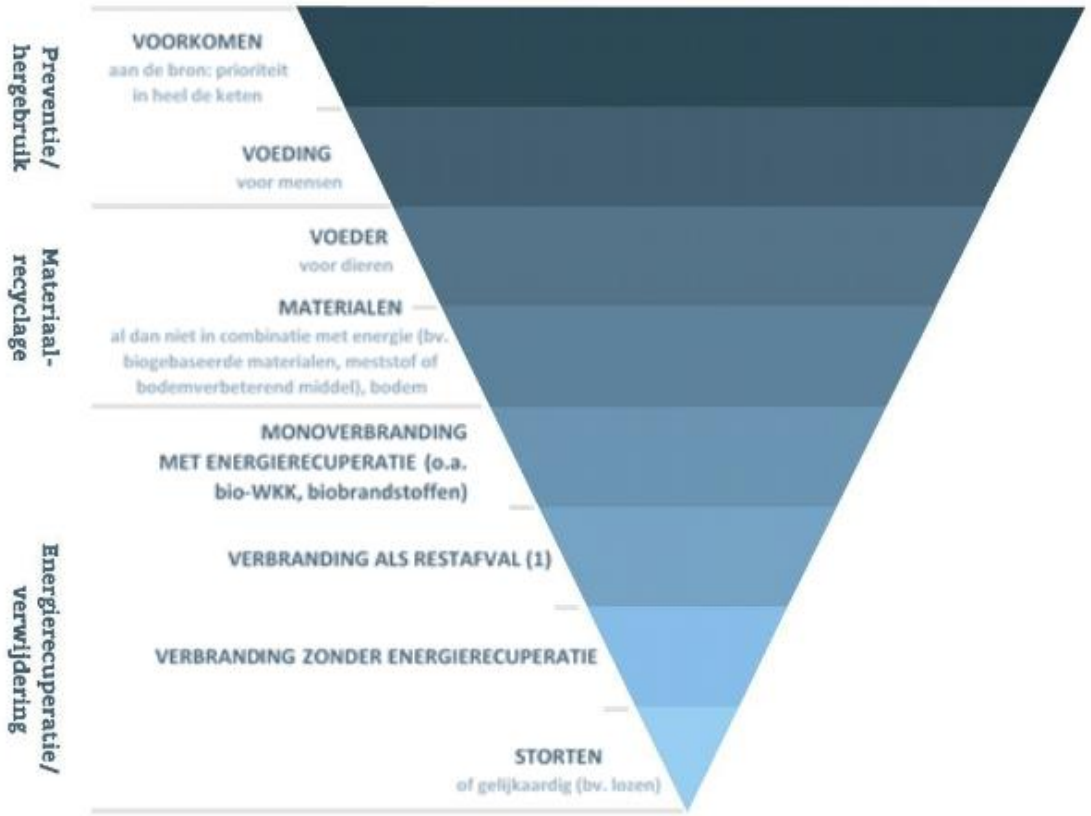
- **Veel vragen**
  - Mogen bepaalde stromen omgezet worden in biochar
  - Statuut van de ingezette biochar (product, afvalstof, brandstof, …)
- **Nood aan een Vlaams standpunt over:**
  - Het pyrolyseren van biomassareststromen
  - Het gebruik van biochar als BVM

- **Samen met VLM, departement omgeving en VEKA tot een voorlopig standpunt gekomen binnen de Vlaamse overheid**

(Los van de discussie rond het vergunnen van de productie-installatie)

Pyrolyseren van biomassareststromen

- **Het afvalstoffenbeleid is gebaseerd op de ladder van Lansink/principe waardebehoud**



Vlaand
is materiaalbewust

EN MAKEN WE
GEN MOOIER
OVAM

Wat is de plaats van biochar op de ladder?

- **Tussen recyclage en verbranden**
  - Er wordt een materiaal, nl biochar, gemaakt
  - maar een deel wordt onder de vorm van syngassen verbrand

➔ **Of de balans overhelt naar materiaal of energie is afhankelijk van de toepassing**

Mag een afvalstof omgezet worden in biochar?

- **Afhankelijk van de biomassareststroom**
  - Negatief voor stromen die nu een materiaaltoepassing hebben
  - Positief voor stromen die nu verbrand worden
  - Een positieve energiebalans is in elk geval noodzakelijk
- **Afwegen of pyrolyseren een wenselijk alternatief is voor de huidige manier van verwerken**
  - Vb stroom die nu vergist wordt, eerst omzetten in biochar en dan gebruiken als BVM
  - LCA studie om verwerkingsmethodes te vergelijken
    - Vgl van effecten
    - Voor vergisting/compostering zijn effecten van gebruik van digestaat gekend, voor gebruik van biochar nog niet

Agenda

- Wat is biochar?
- Pyrolyse van biomassa
- Waar staat biochar in ons afvalstoffenbeleid?
- **Het gebruik van biochar als BVM**
- Bespreken van voorbeelden

Het gebruik van biochar als BVM

- In verweerde en C-arme tropische bodems heeft biochar zijn nut al bewezen
- In jongere, C-rijkere gematigde bodems is het effect van biochar minder éénduidig en de positieve effecten minder aantoonbaar
- Effecten schommelen tussen neutraal en licht-negatief
- Effecten (bv. op het bodemleven) zijn nog te weinig gekend
- EN sterk afhankelijk van karakteristieken van de biochar, inputstroom, hoe het wordt toegediend, …
- Andere BVM, vb compost, blijven nodig en hebben bewezen meerwaarde op bodemkwaliteit

Het gebruik van biochar als BVM

- **We laten dus het gebruik van biochar als BVM niet zomaar toe**
  - Case by case evaluatie door grondstofverklaring
  - VLAREMA parameters
  - EBC (European Biochar certificate) voorwaarden
  - Ontstaan van verontreinigingen tijdens pyrolyse (PAK's)

- **We zijn voorzichtig uit voorzorg, maar willen nieuwe initiatieven wel een kans geven**
- **Verwachten niet dat gebruik van biochar als BVM in de nabije toekomst gaat stijgen, door de hoge kostprijs**

EBC

- **European Biochar Certificate**
  - Ithaka Institute
  - Europese non-profit organisatie
- **Om de risico's van het gebruik van biochar onder controle te houden**
- **Gebaseerd op wetenschappelijke kennis**
- **Ontwikkeld om bij het gebruik of het produceren van biochar de mogelijke negatieve effecten op gezondheid en milieu te vermijden of toch zeker te beperken**
- **Het certificaat is geen verplichting in Europa, behalve in Zwitserland (bij gebruik in landbouw)**
- **Maar meer landen gebruiken het als een richtlijn**

Voorlopig(!) standpunt samengevat

- **Toegelaten stromen; zij die niet in aanmerking komen voor materiaalrecyclage en dus momenteel verbrand worden**
- **Toegelaten als BVM indien de biochar;**
  - Voldoet aan het EBC voor de relevante certificaatklasse (EBC-agro, EBC-AgroOrganic of EBC-Urban)
  - Voldoet aan de normen van bijlage 2.3.1.A van het Vlarema
  - Een GV is verkregen.

Inhoud

- Wat is biochar?
- Pyrolyse van biomassa
- Waar staat biochar in ons afvalstoffenbeleid
- Het gebruik van biochar als BVM
- **Bespreken van voorbeelden**

VB 1: houtige fractie groenafval

- **Huidige verwerkingswijze**
  - Compostering
  - verbrandingsverbod
- **Energetisch gezien – houtig materiaal, verwachten OK**
- **Stroom die VLAREMA conform is**
- **Maar de huidige verwerking is een materiaaltoepassing**
- **Dus laten we het maken van biochar uit de houtige fractie van groenafval niet toe**

- **Zeefoverloop van Groencompostering**
  - Valt niet onder verbrandingsverbod
- **Kan dus wel worden ingezet voor biochar productie**

VB 2: houtige fractie fruitbomen

- **Huidige verwerkingswijze**
  - Afvoer naar compostering?
  - Ter plaatse onderwerken
  - verbrandingsverbod
- **Stroom die VLAREMA conform is, kan gebruikt worden als BVM**
- **voordelen biochar als BVM**
- **Voordelen biochar tov rechtstreeks onderwerken**

VB 3: kippenmest

- **Kippenmest is geen afvalstof**
  - Valt onder de bevoegdheid van VLM
  - Geen OVAM bevoegdheid
  - Valt niet onder materialendecreet
- **Afgetoetst met VLM**
- **Relatief vaste meststof**
- **Huidige verwerkingswijze**
  - Gebruik als champignonsubstraat – zeer waardevol substraat
  - compostering
  - Uitvoer uit Vlaanderen
- **Kippenmest is geen probleemstroom voor afzet**
- **Kippenmest heeft een lage C-inhoud (lage C:N-verhouding)**
  - Lage biochar-opbrengst
  - Verlies plantvoedingsstoffen
- **Omzetten tot biochar laagwaardiger als huidige verwerkingsmethoden**

Vlaanderen
is materiaalbewust

Dank voor uw aandacht
Zijn er nog vragen?

Vlaamse overheid
Openbare Vlaamse Afvalstoffenmaatschappij
Stationsstraat 110 - 2800 Mechelen
T 015 284 284
ovam.vlaanderen.be
info@ovam.be

Blijft u graag op de hoogte?

Schrijf u in voor onze nieuwsbrief via nieuwsbrief@ovam.be.

SAMEN MAKEN WE MORGEN MOOIER
OVAM

Katleen Van den Eynden

KBG Biomassa

Concept: Klankbordgroep
Wanneer: 3 keer per jaar
Waar: UHasselt Campus Diepenbeek
Inhoud: 4 sprekers + netwerking

Inschrijven via BASTA team

Sprekers 12/10/2023 (14u-17u)

Stijn Boeren (Avecom): Valorisatie nevenstromen door biomassa fermentatie

Jasper Bloemen (GLIMPS.bio): Agentschap bio-based economy

Caroline De Tender (Prof. UGent): Microbioom in chitine- & biochar-related plantengroeipromotie

Jane Debode (ILVO): Biochar in aardbeienteelt: resultaten uit het BASTA project

BASTA

CMK CENTRUM VOOR MILIEUKUNDE UHASSELT

ILVO Instituut voor Landbouw-, Visserij- en Voedingsonderzoek

Ecotron Tour

Prof. dr. Natalie Beenaerts

Prof. dr. Nadia Soudzilovskaia

fwo Research Foundation Flanders
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Reception @ Euroscoop/Pathé

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Thank you for coming...
ECOTRON
HASSELT UNIVERSITY
... and enjoy the tour!