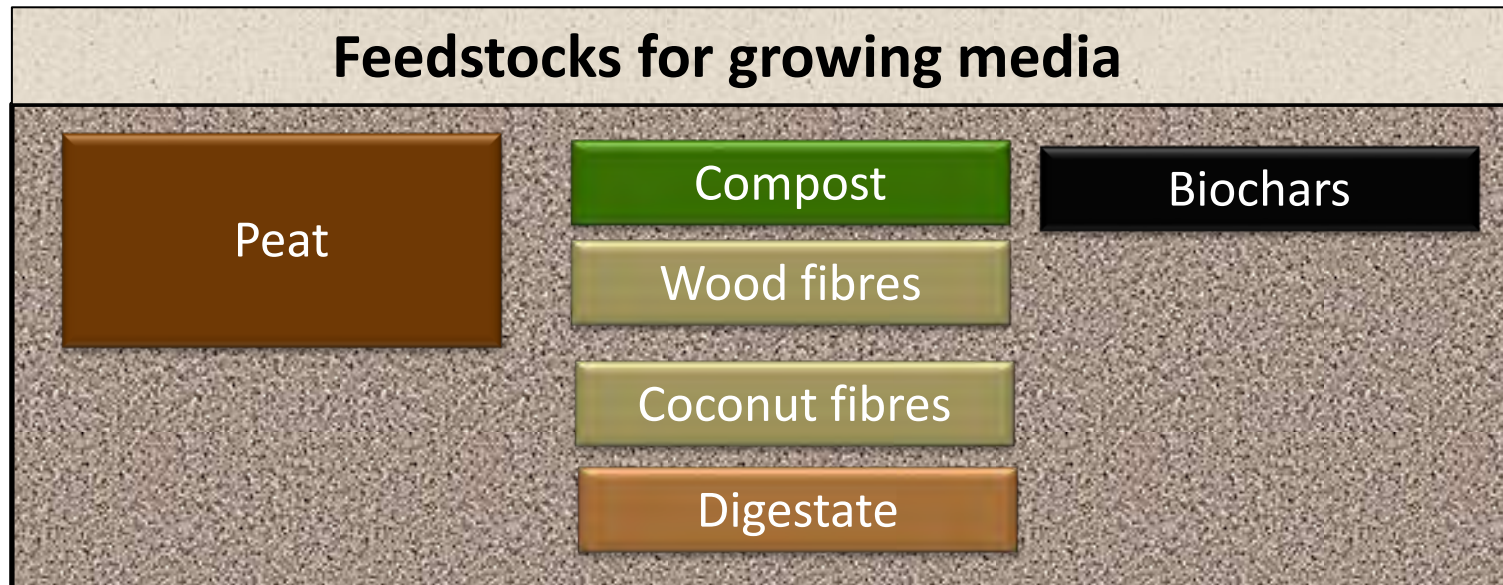


Rice husk hydrochar increased germination of *Lepidium sativum* L. compared to char-free soil

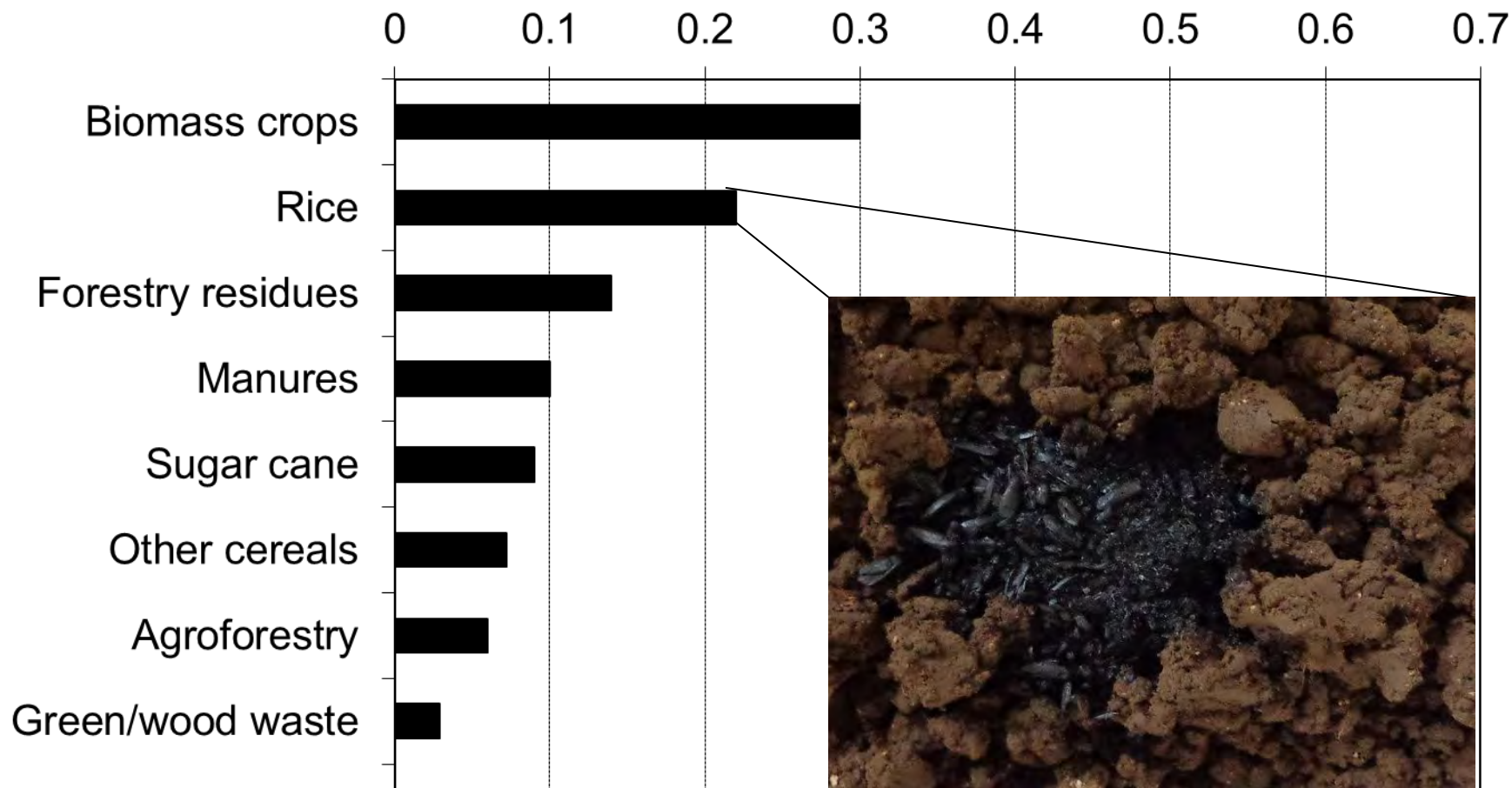
Christiane Dicke, Irina Mukhina,
Dimitrios Kalderis, Jürgen Kern

Objectives

- *Potential of Biochars to substitute culture media deriving from peatlands*
- *Preservation of peatlands, which can be found over a wide area for example in the Baltic countries by reducing high pressure on these carbon rich ecosystems*
- *The application of Biochar may have drawbacks such as the accumulation of organic and inorganic toxic compounds. Knowledge has to be enhanced about ecotoxicological effects of Biochars on the soil biota*



Annual globally sustainable biomass feedstock availability (Gt carbon per year)



Woolf et al. (2010)

Nature Communications 1, 1-9.

Thermochemical carbonisation process

Hydrothermal carbonisation (HTC)

- wet and anaerob
- 180-300°C
- < 50 bar
- C yield 50-80%



HTC autoclaves at TU Crete



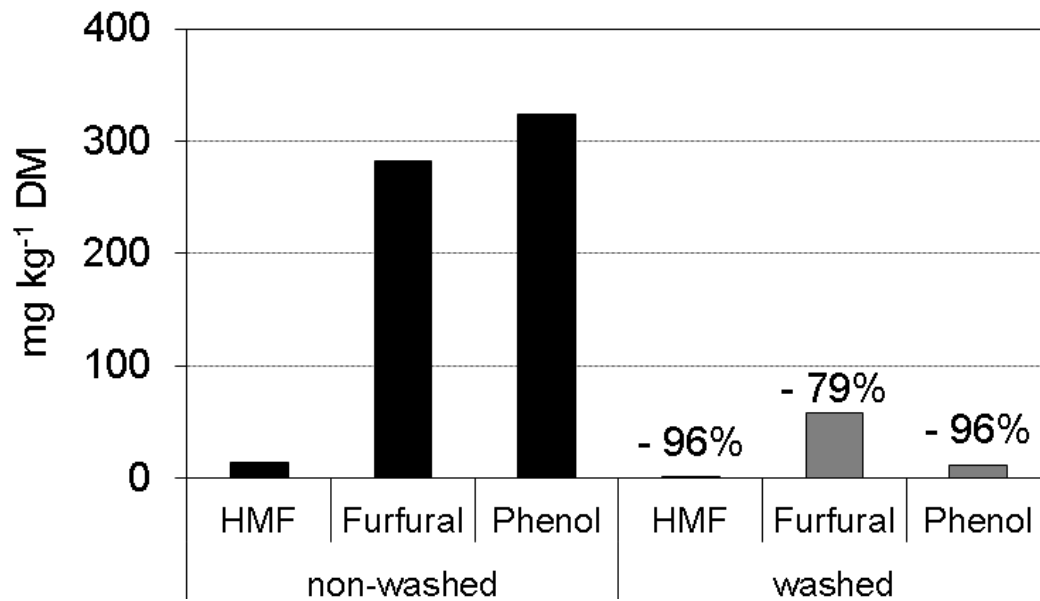
HTC plant with 20 L fermenter at ATB Potsdam

Experimental set-up

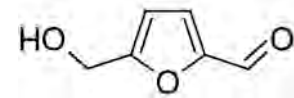
- Hydrothermal carbonisation at 200°C for 6 hours
- Post-treatment of HTC char by washing with acetone and water
- Chemical characterisation of furfurals and phenol by HPLC
- Germination and growth test of cress for 96 hours



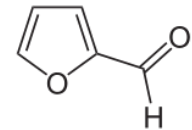
Presence of toxic compounds



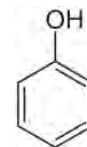
Hydroxy-Methylfurfural



Furfural



Phenol



Chemical properties of rice husk and their HTC chars

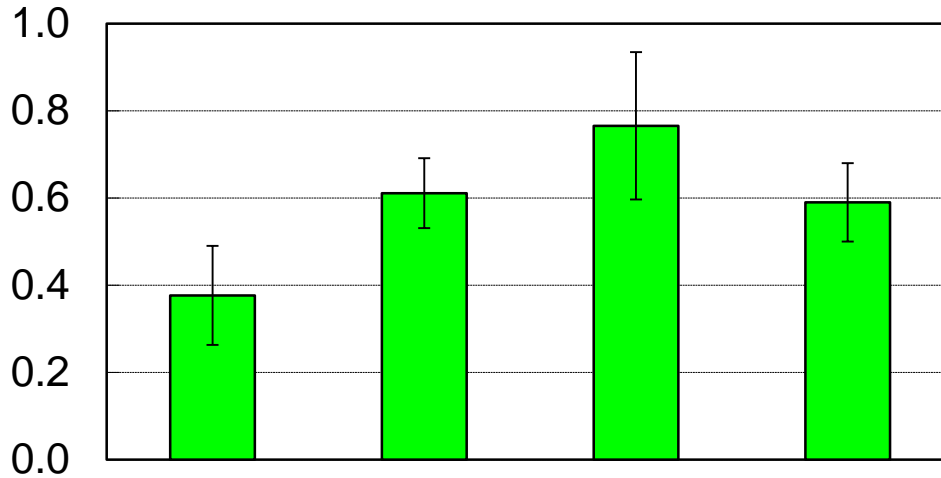
		Rice husk	HTC char (200°C)	
		raw	unwashed	washed
DM (105°C)	% FM	93.5	95.4	97.4
pH		6.17	3.95	4.70
HMF	mg kg ⁻¹ DM	n. d.	14.2	0.6
Furfural	mg kg ⁻¹ DM	2.4	282.0	58.5
Phenol	mg kg ⁻¹ DM	n.d.	324.3	12.0
Carbon	% DM	39.98	45.37	41.34
Phosphorus	% DM	618	389	<5

Comparison to peat

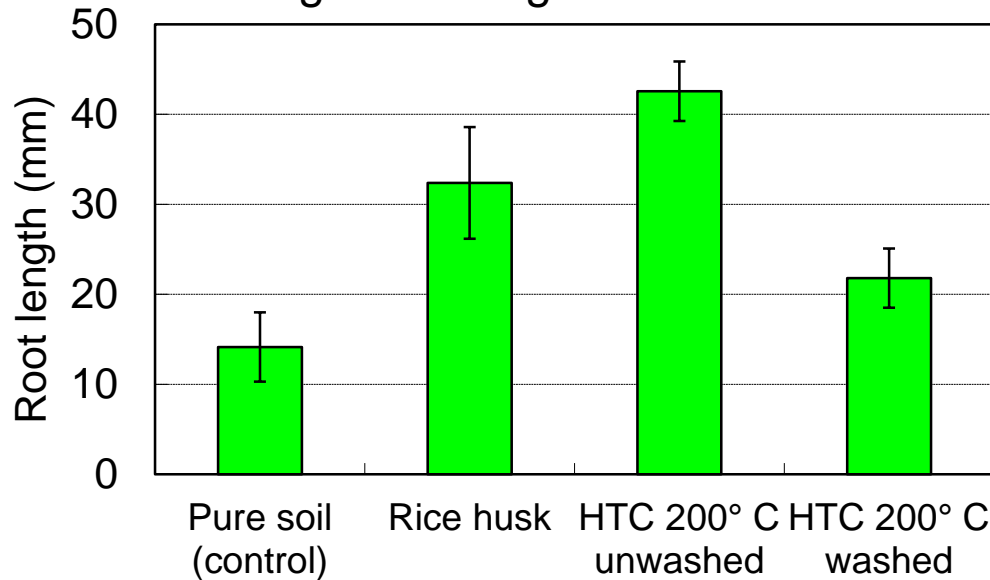
	Feedstock	Organic matter % DM	pH	Salt g KCl/l	Na mg/l	EC μS/cm	Nmin mg/l	P ₂ O ₅ mg/l	K ₂ O mg/l	Source	
Targets											
	Peat	black peat	≥ 90	≤ 4.5	≤ 1.5	≤ 50	≤ 500	100-250	100-300	150-400	RAL-GZ 250/5-2
	Growing media		5.0-6.5	≤ 3.0	≤ 500			<i>to be declared</i>		RAL-GZ 250	
Chars											
	HTC char, unwashed	rice husks	75	4.0		830	5-10			Chakrabarti et al. (2015)	
	HTC char, washed	rice husks	74	4.7		50	5-10			Chakrabarti et al. (2015)	

Effect of HTC char on cress growth

Average germination rate

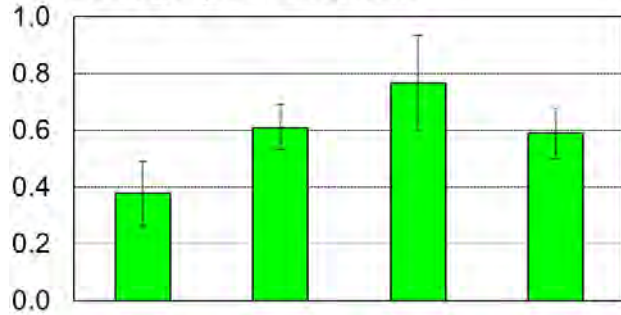


Average root length

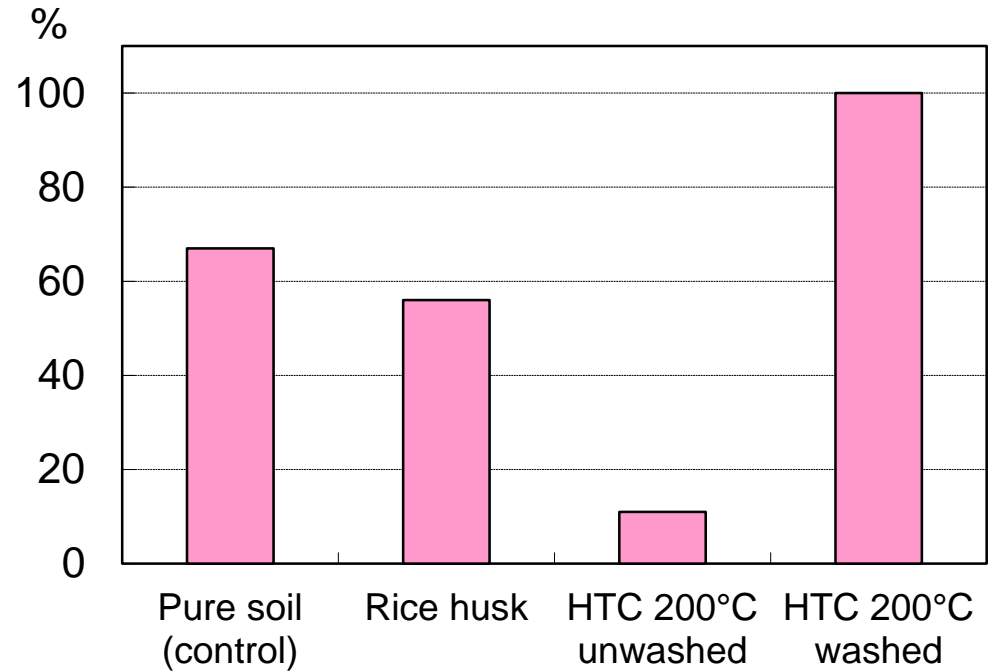
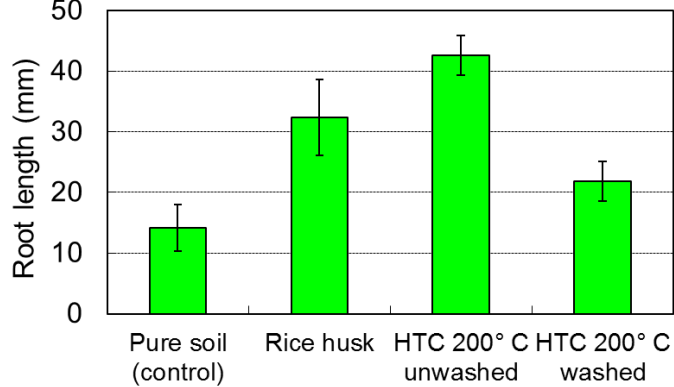


Fungal development

Average germination rate



Average root length



Conclusions

- Rice husk HTC char has characteristics (pH, N_{\min}) that are suitable for peat replacement
- HTC char did not inhibit cress germination or plant growth
- Washed HTC char had shorter roots and more fungal growth than unwashed HTC char
- Harmful substances like furfural or phenol can be removed by drying

Future Research in Peat replacement

- Biochar or hydrochar as new types of peat dilution materials
- Effects on plant stimulation, disease control, microbial and fungal activity

Thank you for your attention!