

Ashes from fast pyrolysis bio-oil production of different waste streams may be suited as soil amendment

HERAKLION

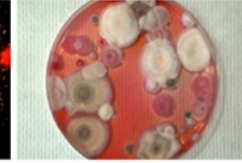
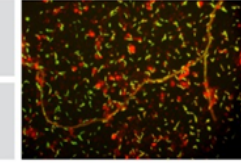
7th International Conference on Sustainable Solid Waste

M. Probst, M. Fernández-Delgado Juárez, M. Gómez-Brandón, V.

Turan, H. Insam

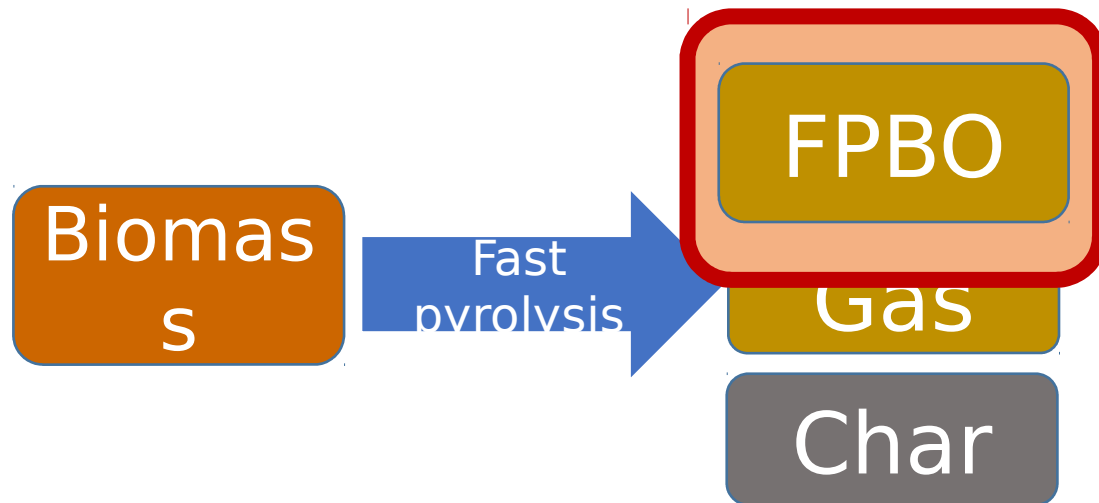
Management, 28.06.2019

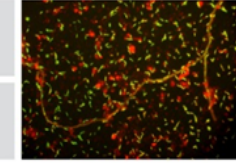




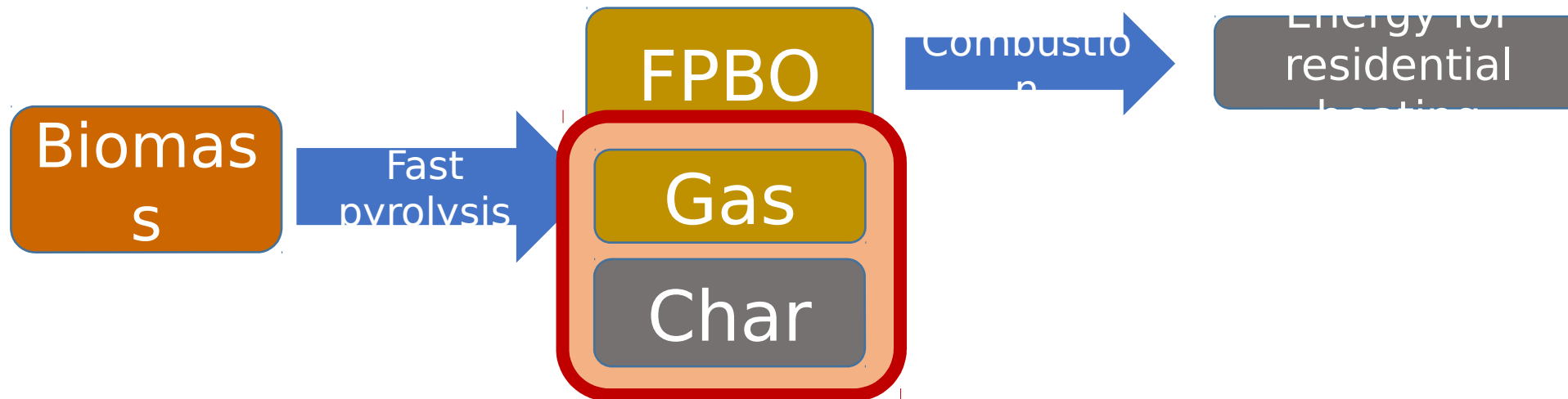
Replace fossil fuels by renewable, sustainable resources

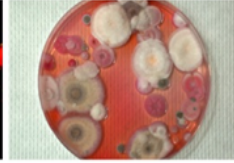
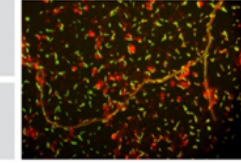
□ Biomass





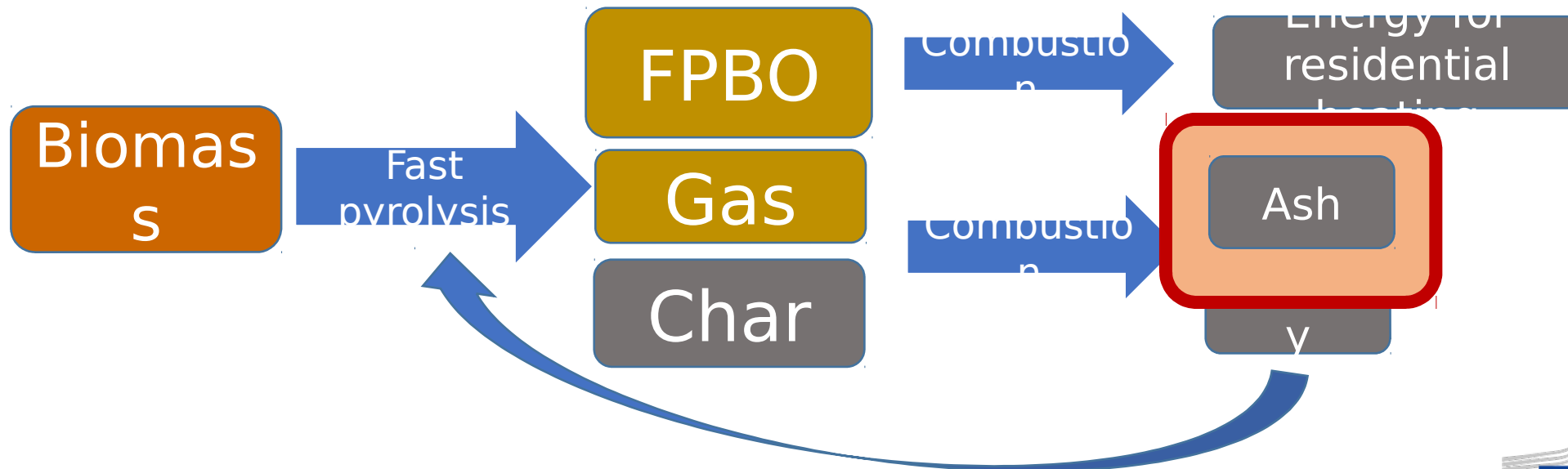
Utilisation of different biomass types for residential heating

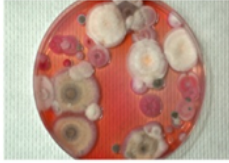
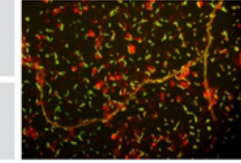




What to do with the ash?

- Landfilling
- Cement industry



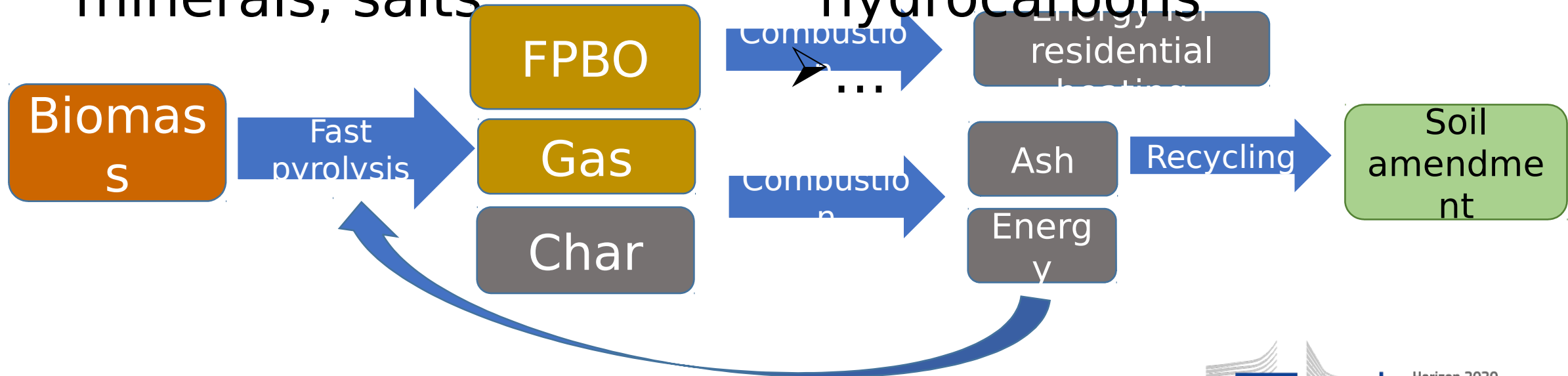


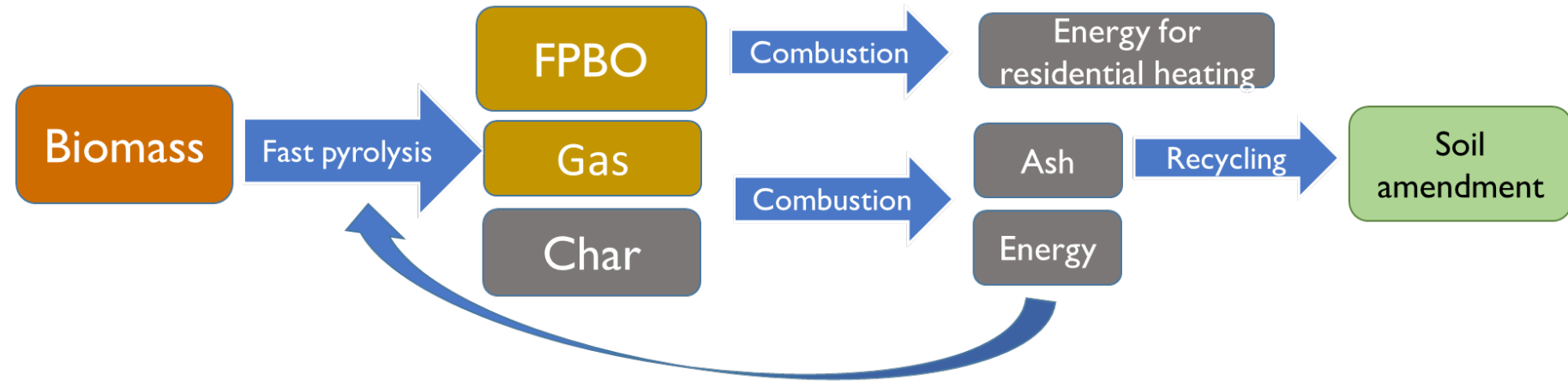
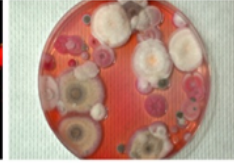
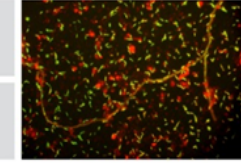
Advantages:

- Buffering of soil pH
- Nutrients: Carbon, minerals, salts

Disadvantages:

- (Heavy) Metals
- Polycyclic hydrocarbons

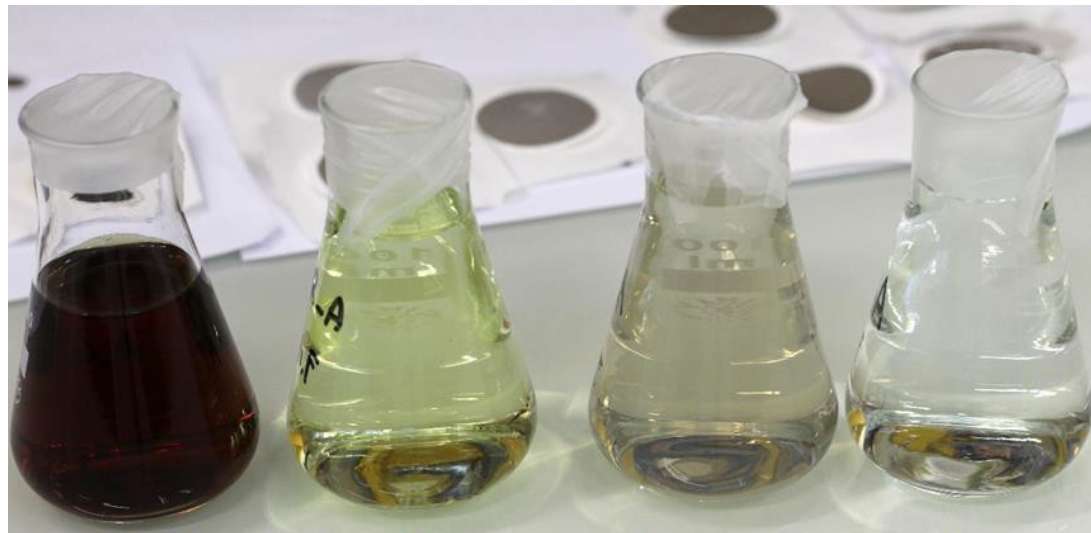
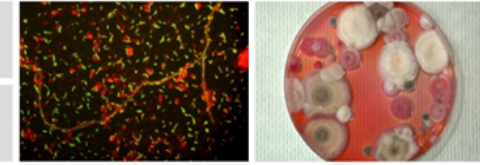




Tasks

- Characterise the ashes from different biomass types
- Apply ashes to grassland soil
- Monitor soil properties and plant biomass

Ash properties



Wheat
straw

Forest
residues

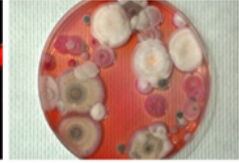
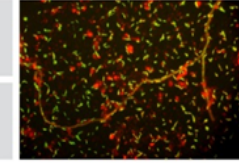
Miscanthus
sp.

Bar
k

Characterisation

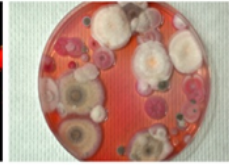
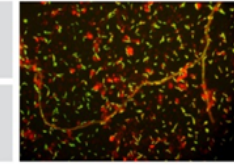
- pH
- (Heavy) Metal content
- Electrical conductivity
- Carbon content
- Phytotoxicity
- ...

Ash properties

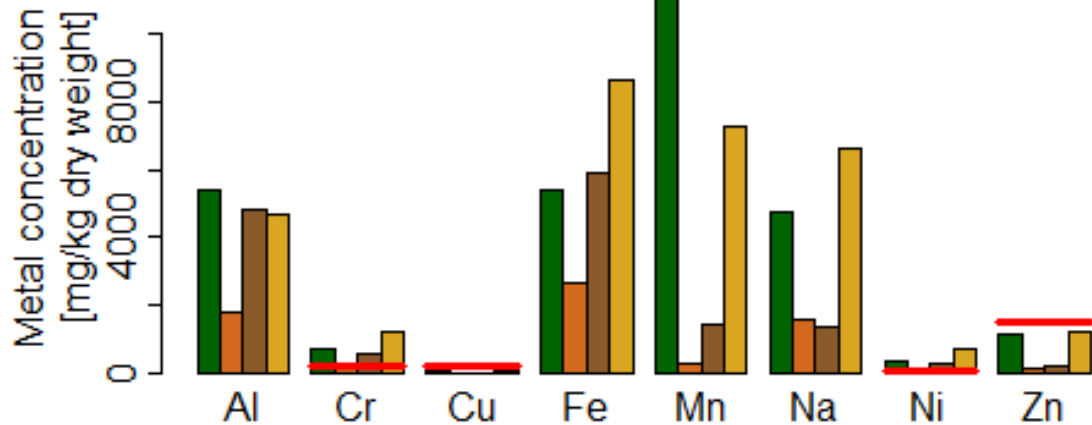
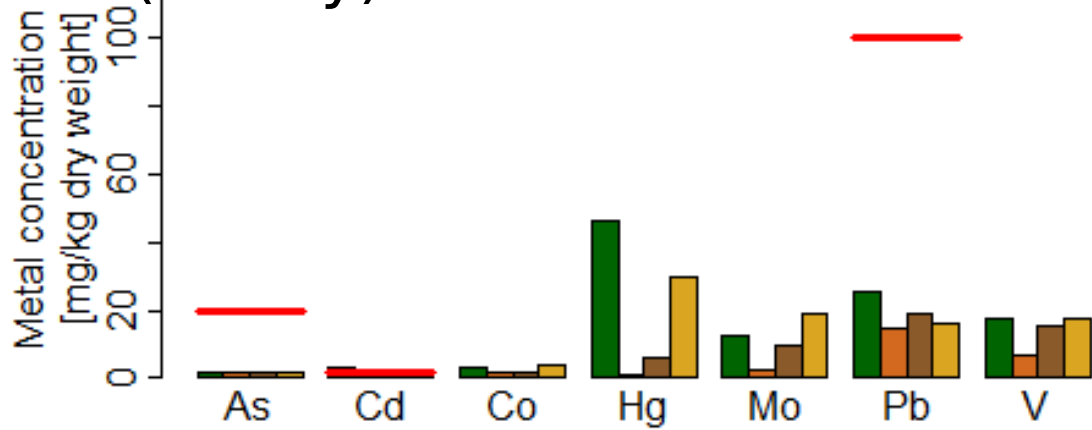


- pH > 12
- Carbon content up to 18%_{dry mass}
- Phosphor content up to over 340 mg kg⁻¹

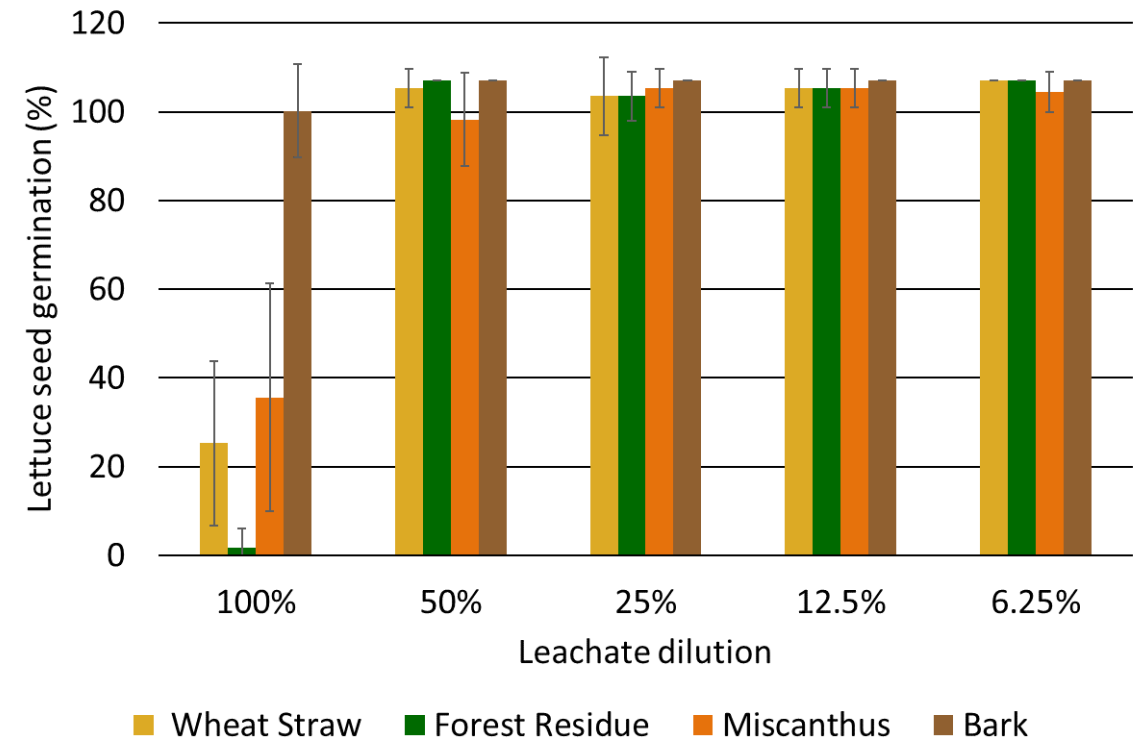
Ash properties



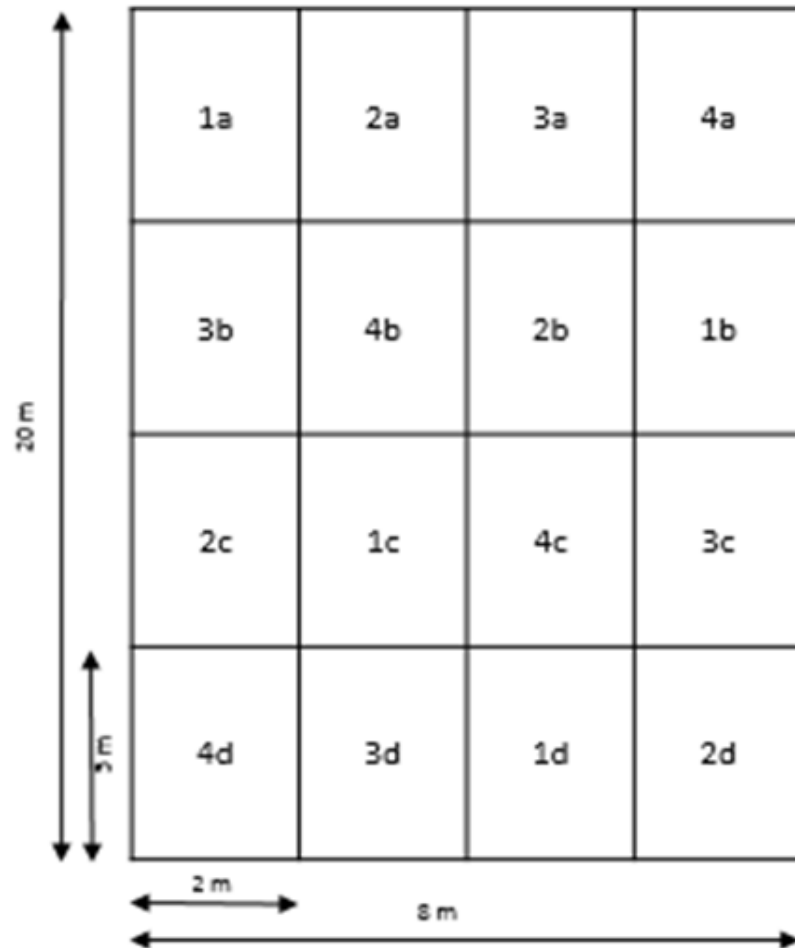
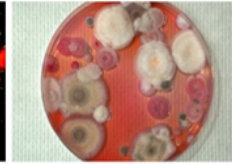
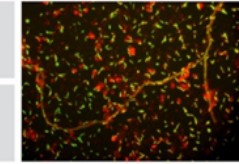
(Heavy) Metal contents

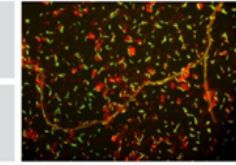


Phytotoxicity



Field trial





Ash addition:

- 500 kg ha⁻¹ a⁻¹ (BMLFU guidelines) in autumn

Fertilization

- Cattle manure in spring (180 kg N ha⁻¹ a⁻¹)

1. Control

2. Bark-FPBO-Ash

3. Miscanthus-FPBO-Ash

4. Forest residues -FPBO-Ash

!!Ash from wheat straw contained too high amounts of mobile Cr and Ni. It was not

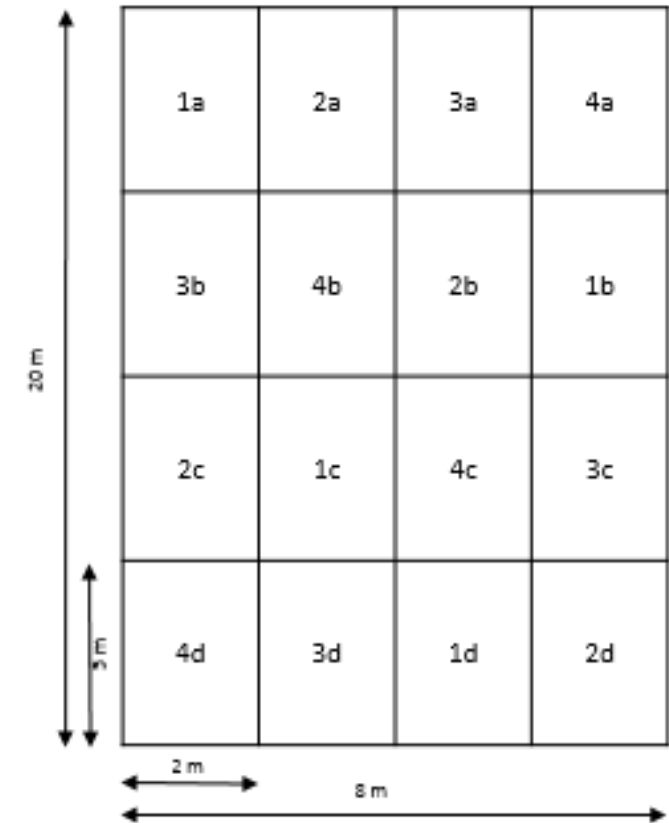
Sampling

Soil:

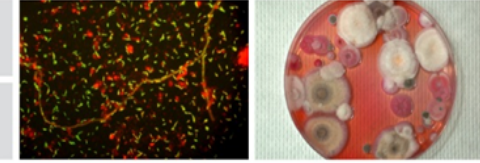
- Beginning and end of the growth period

Plant biomass:

- 3 cuttings during the growth period



Field trial



Analyses

Physicochemistry

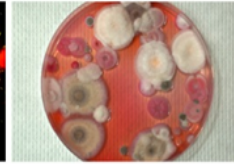
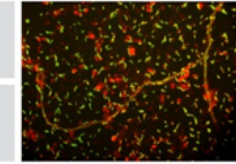
- pH
- Electrical conductivity
- Nitrogen
- Carbon
- Phosphorous

Microbiology

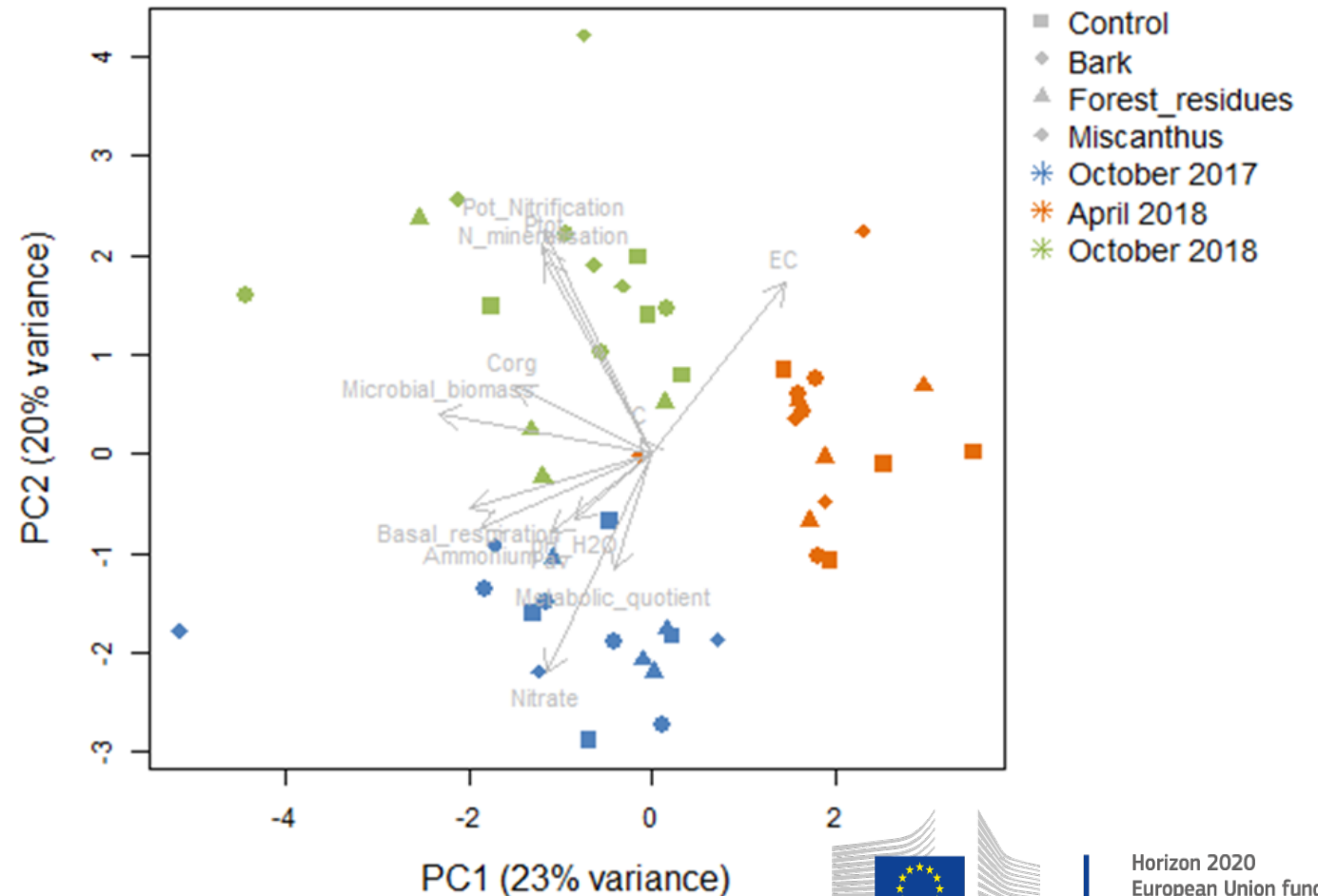
- Soil respiration
- Microbial biomass
- Abundance of genes involved in N-cycle (Amo-A, Amo-B)

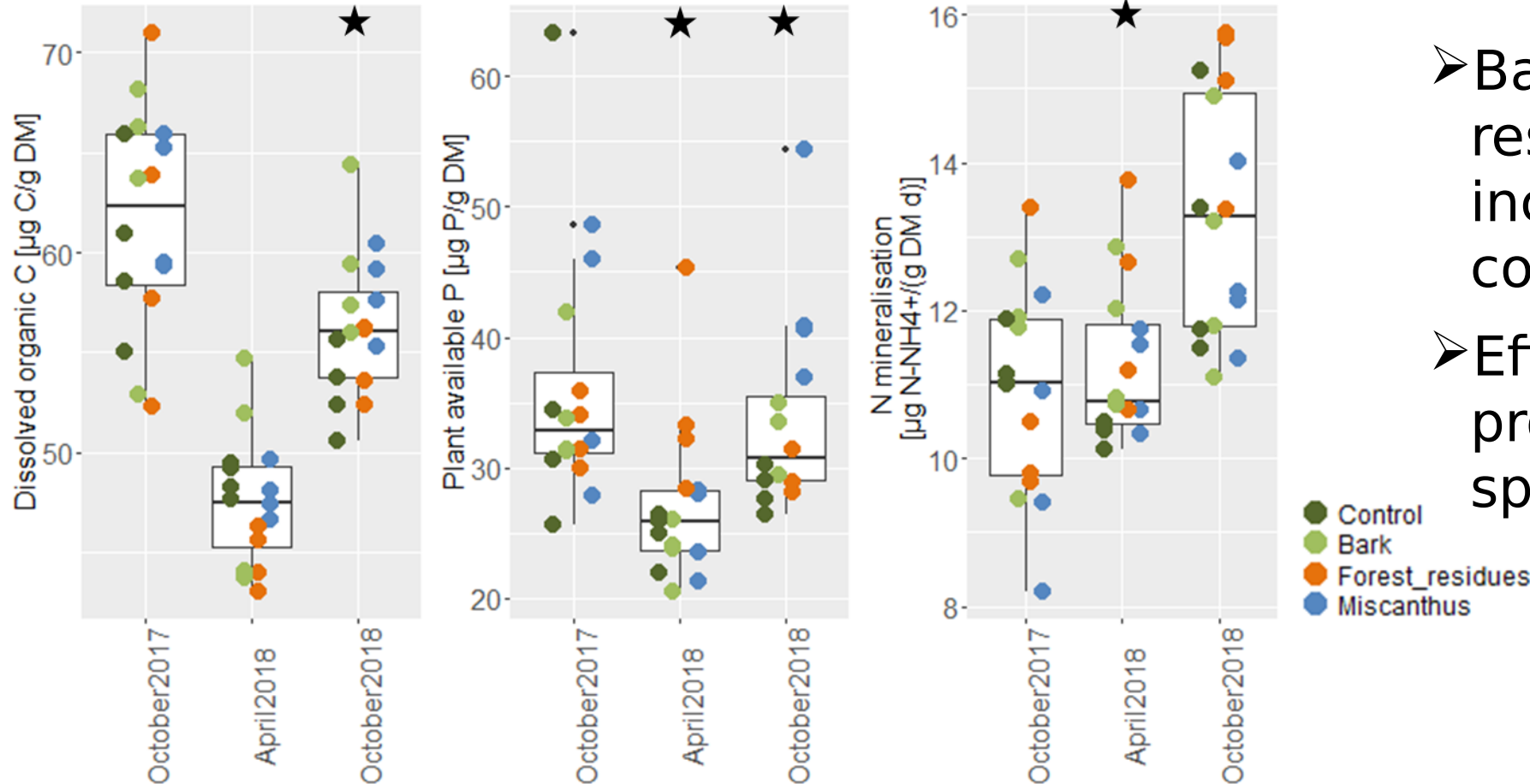
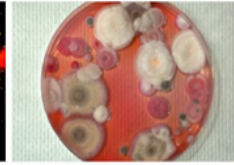
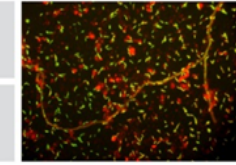
Plant biomass

- Plant biomass
- 3 Cuttings

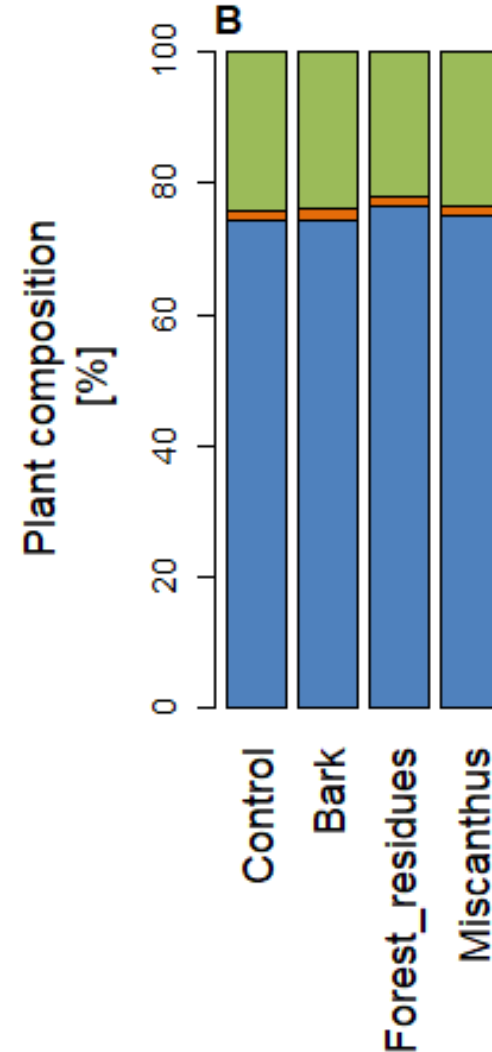
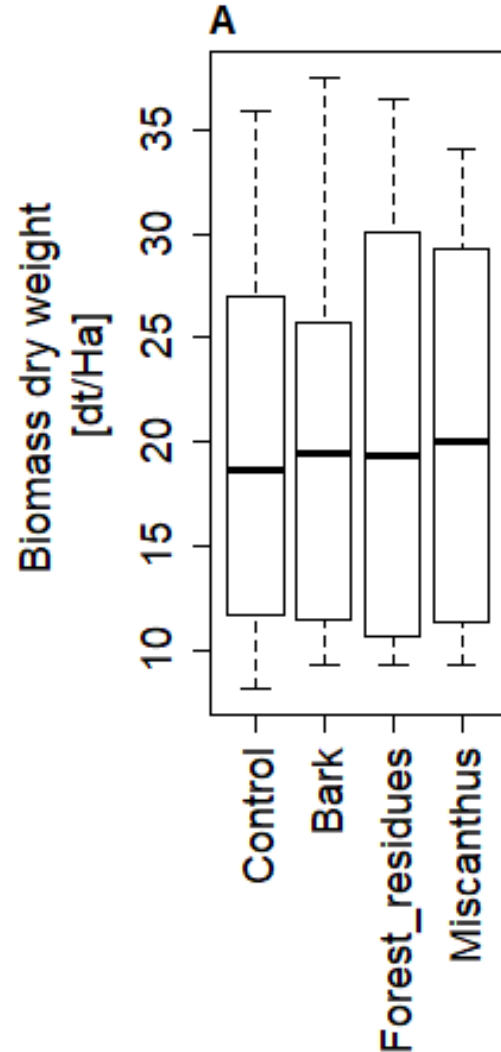
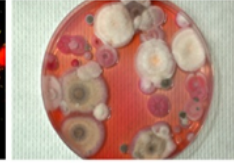
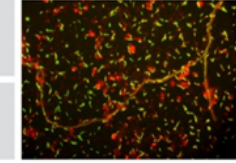


- Only seasonal changes
- Ash amendment does not affect physico-chemical soil properties

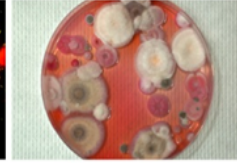
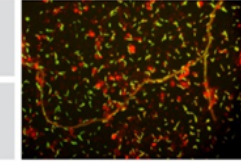




- Bark & Forest residues ash increase nutrient contents in the soil
- Effect is more prominent during spring...

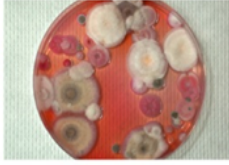
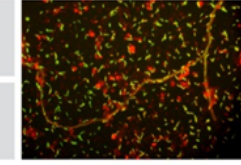


- Very dry year 2018
- Ash amendment **does not affect** plant growth
- Ash amendment **does not affect** plant composition

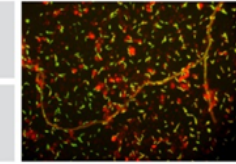


Ash amendment

- has no huge effect on soil properties
 - increases the soil pH
 - increases soil nutrient contents
 - does not affect plant growth and composition
- seems to be applicable as soil amendment.



- Ongoing field trial for possible long-term effects
- Analysis of (heavy) metal contents in soil and hay after a longer application period
- Nutrient analysis of plant biomass
- Soil microbiome analysis



All collaborators
All funders
All of your attention!

The *Residue2Heat* project has received funding from the European Union's Horizon 2020 Research and Innovation programme under Grant Agreement No. 654650



Horizon 2020
European Union funding
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