Carbon from Methane Pyrolysis (CMP) – a Carbonisate Applied to Soil

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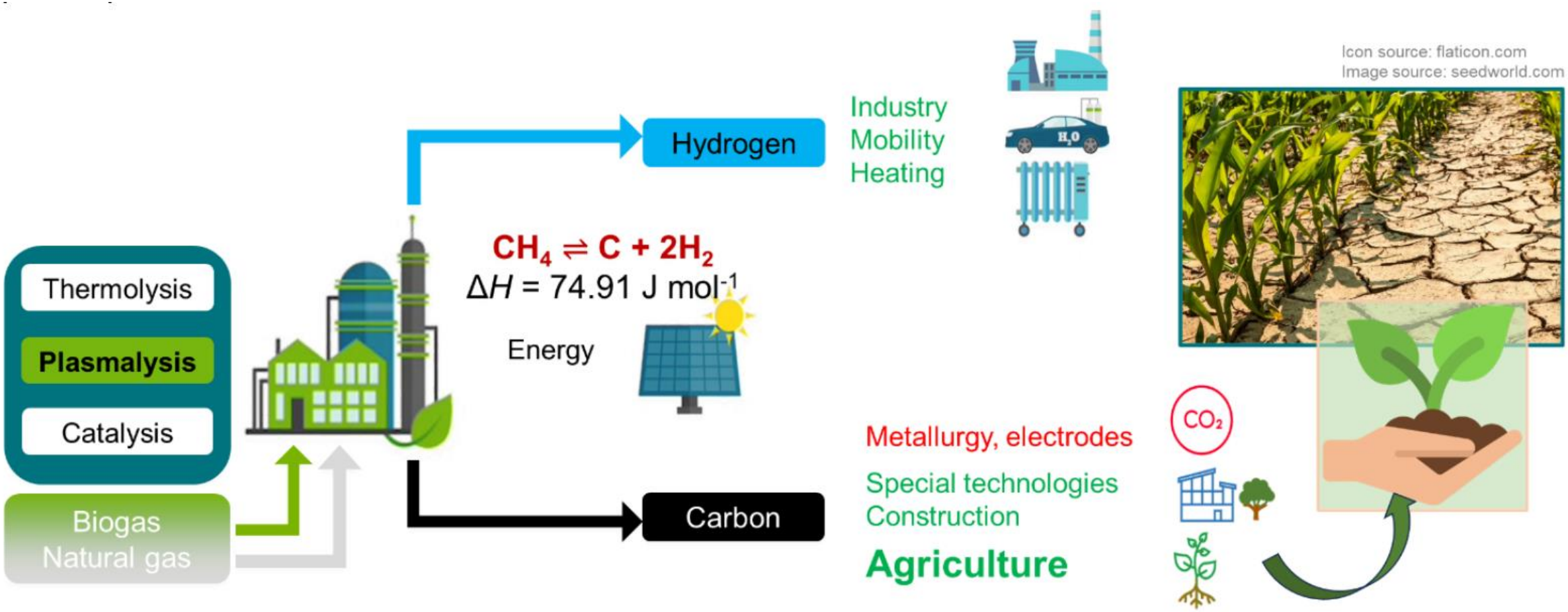
WHERE RESEARCH MEETS THE FUTURE

Methane plasmalysis generates hydrogen - and carbon
(CMP…carbon from methane plasmalysis)

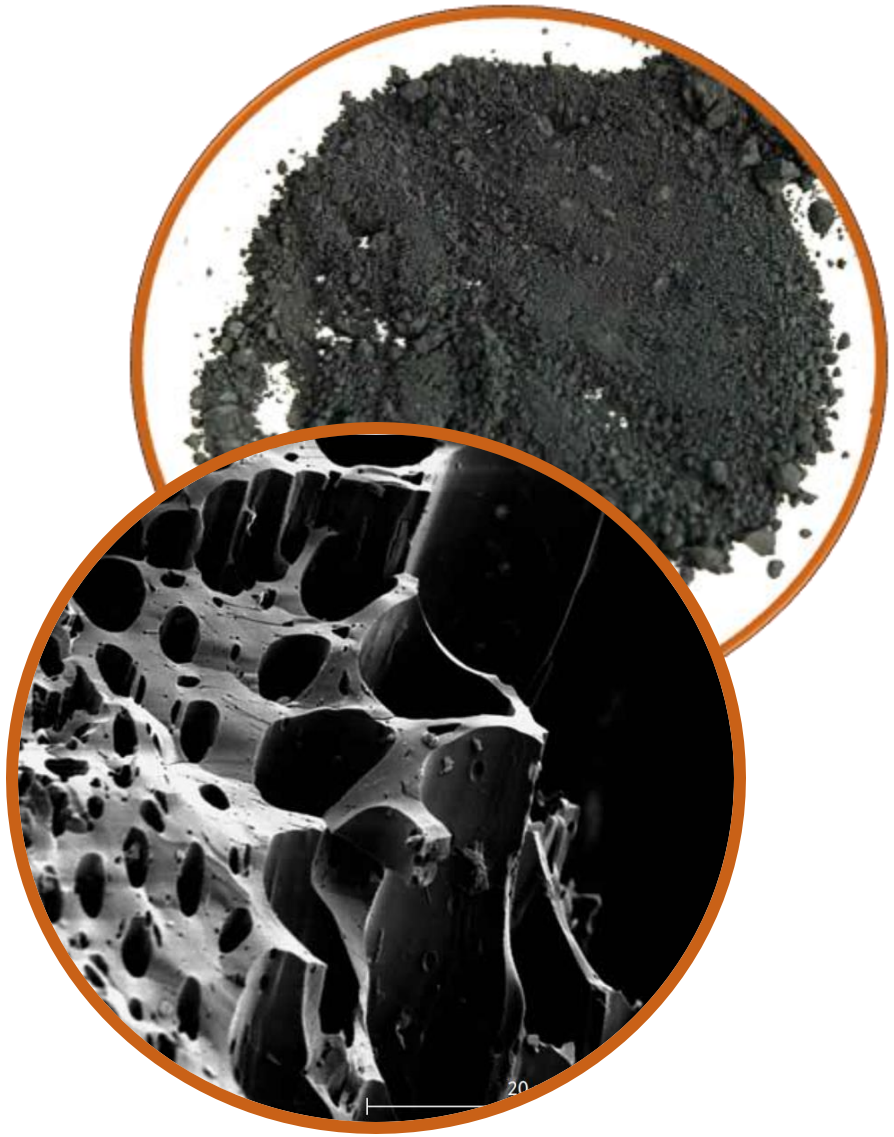


H2-C Facility opening September 2023

Kremsmünster

RAG Austria AG is the largest gas storage operator & energy storage company in Austria.

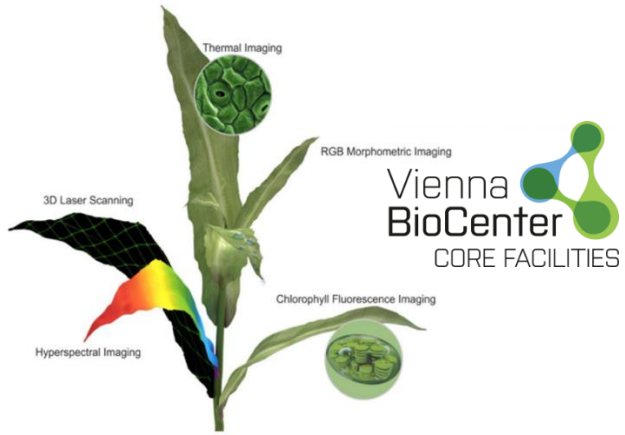
Application of biochar carbon on soil improves its properties
Is this also valid for CMP?



- Carbon storage in soils
- Improved soil structure
- Improved water-holding capacity
- Enhanced soil fertility
- Increased microbial activitiy and diversity
- Reduction of greenhouse gas emissions (N_2O)

CMP: characterisation and assessment of effects on soils and plants

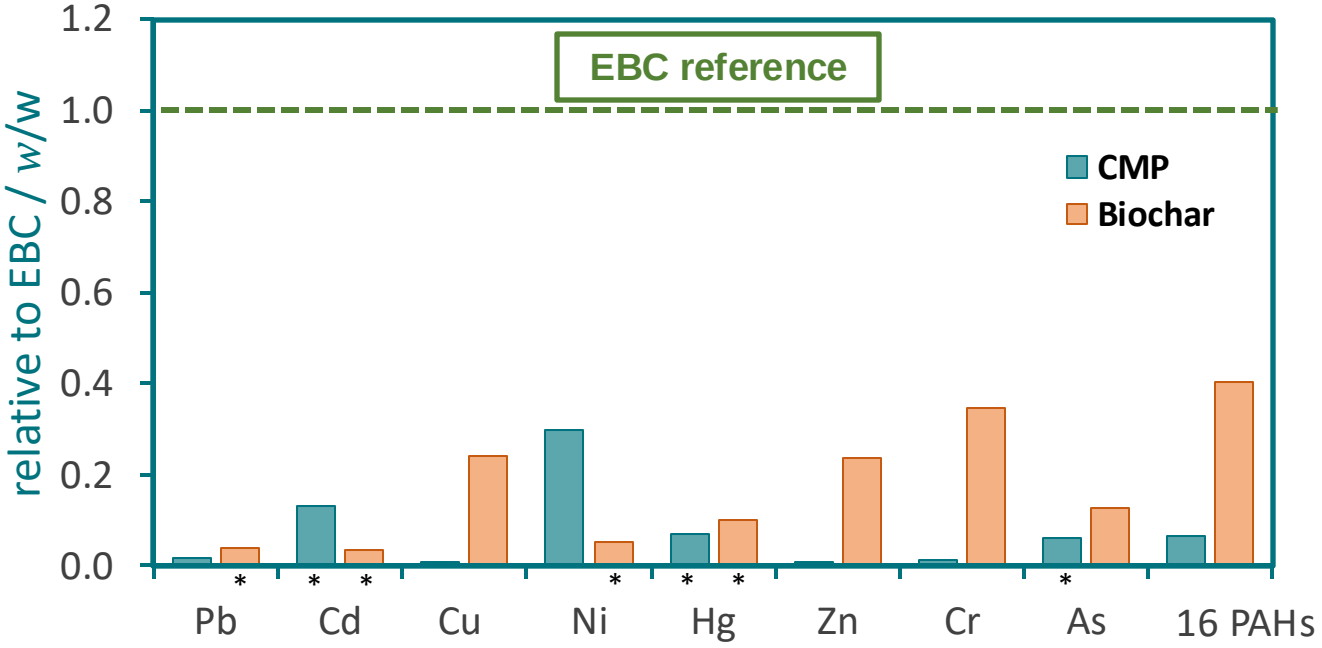
- **characterization** of physico-chemical CMP properties
- **Assessing the effect of CMP on soil characteristics and plant growth** in greenhouse and field experiments
- Processing of CMP for **pelletization**
- **Assessing the effect** of CMP **on water availability and drought stress mitigation in** in the PHENOPlant facility



Characterization of physico-chemical CMP properties

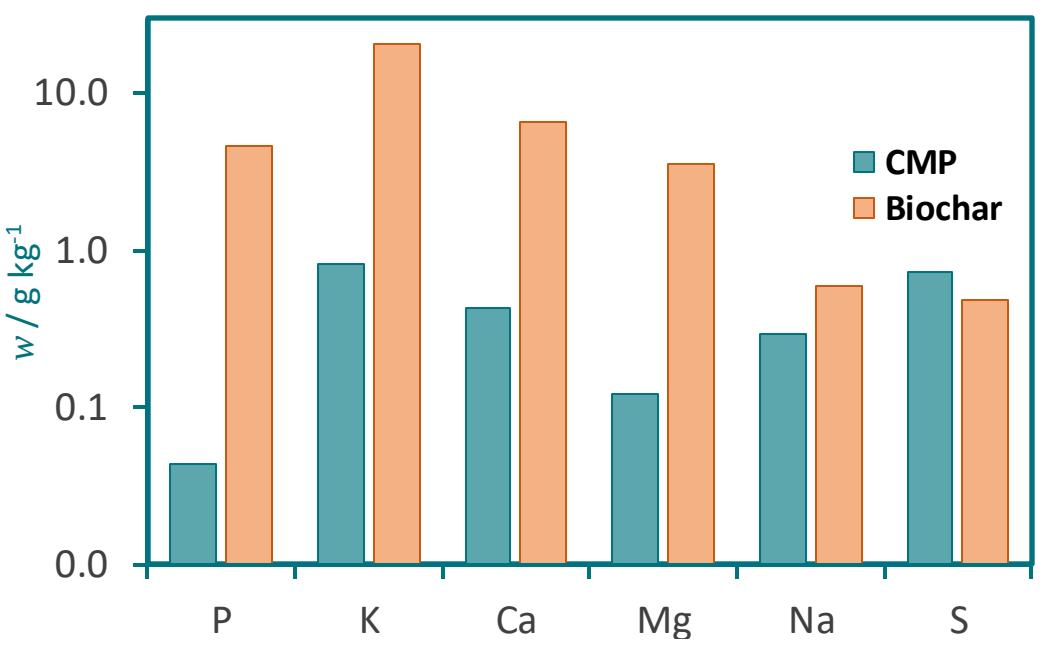
Elemental composition relative to European Biochar Certificate (EBC)

Trace metal(loid)s + PAHs



Data: Ruhr Lab GmbH

Essential macronutrients



CMP is safe to use ✓

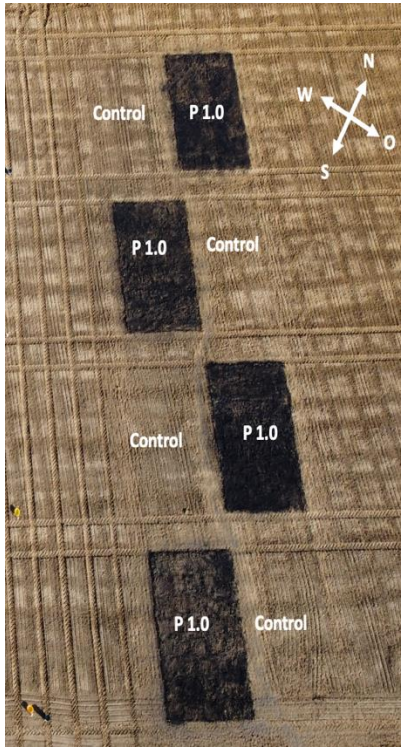
trace metal(loid)s and PAH levels in CMP conform with EBC thresholds

CMP contains very low levels of essential macronutrients

Effect of CMP on soil characteristics and plant growth

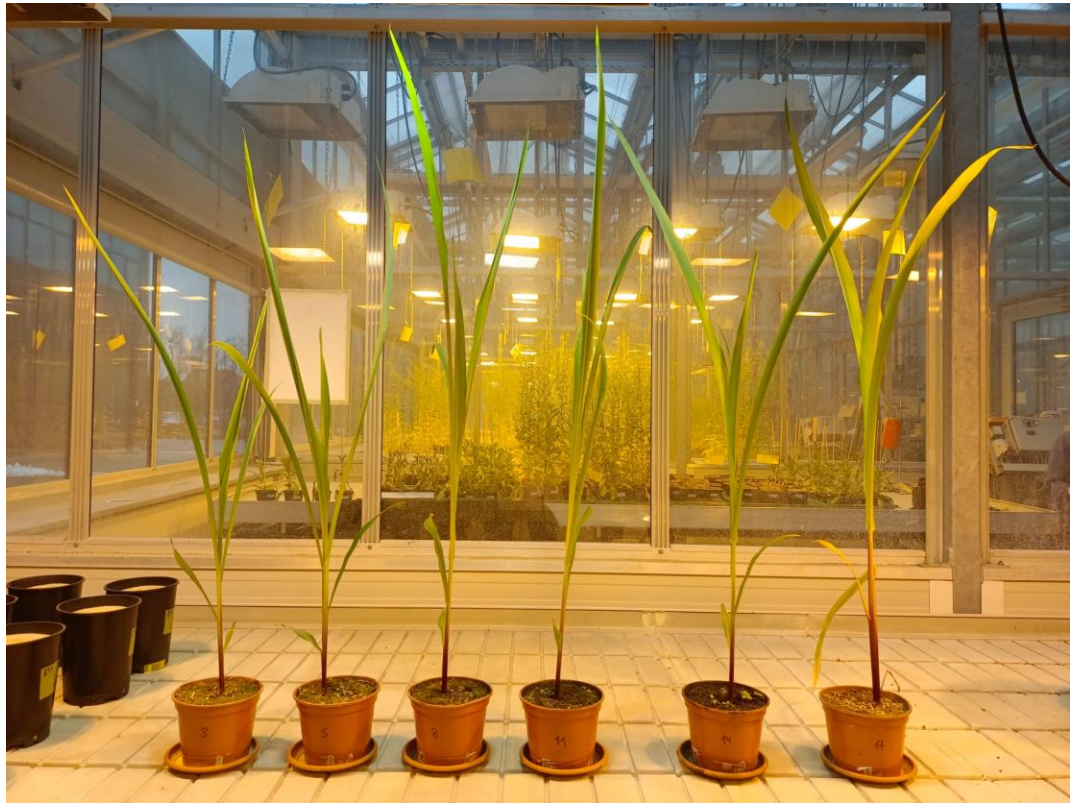
(a) Greenhouse, BOKU & MUL

(b) Field, Grabenegg (NÖ)



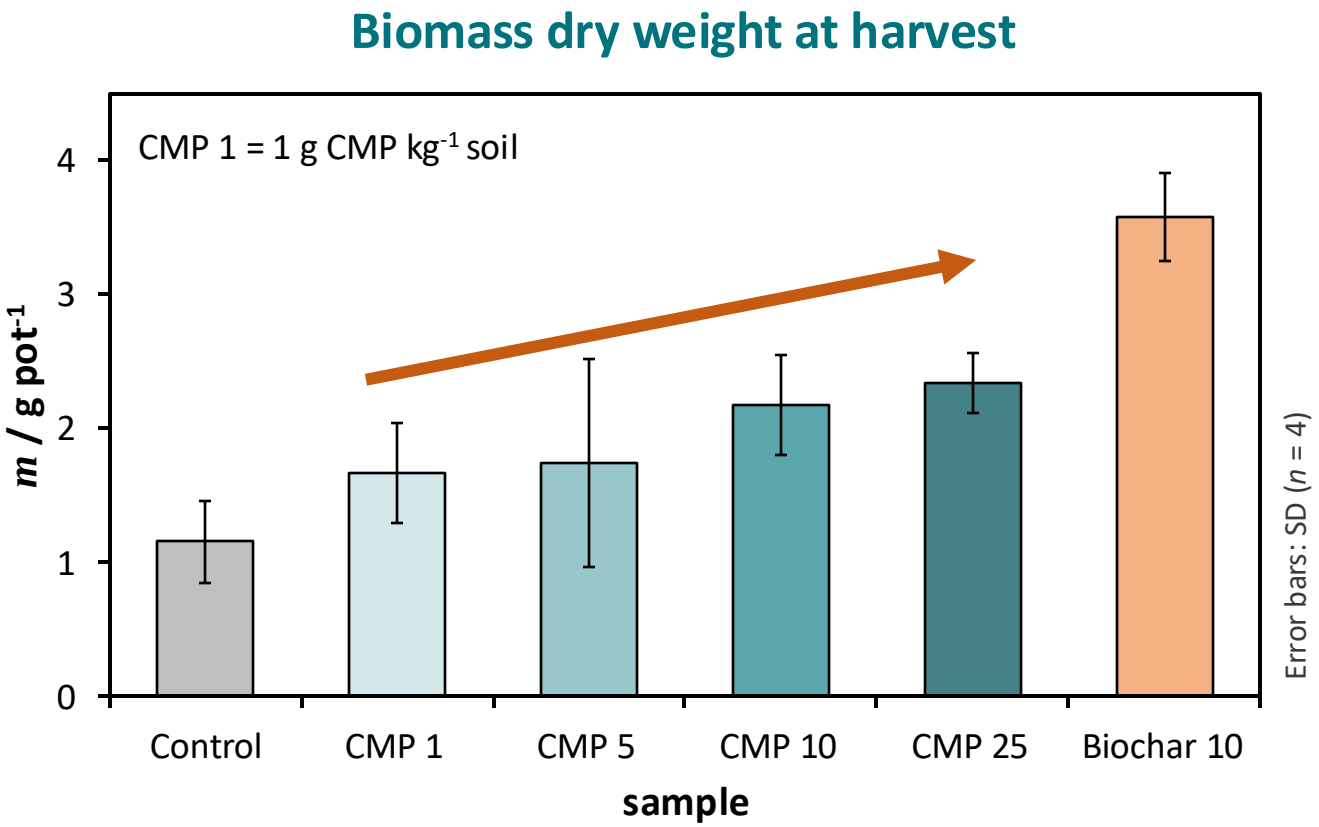
(c) PHENOPlant, VBC

(a) Greenhouse experiment: aboveground biomass



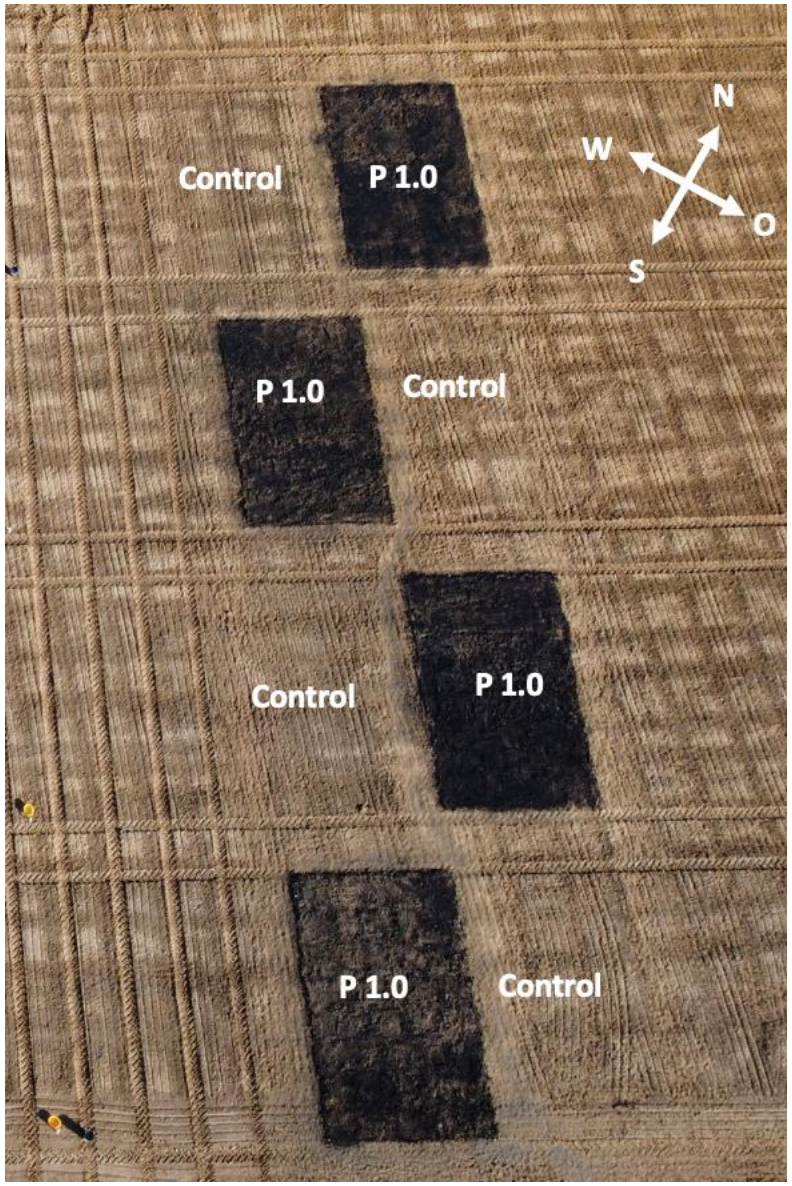
Control CMP1 CMP5 CMP10 CMP25 Biochar10

- Experimental crop: maize (*Zea mays* L.)
- Agricultural soil (Kaltenegg, Lower Austria)
- Growth for 7 weeks



- **Increasing plant biomass with increasing CMP in soil**
- Biochar performs best due to relatively high nutrient contents in addition to carbon

(b) Field experiment, Grabenegg 2022



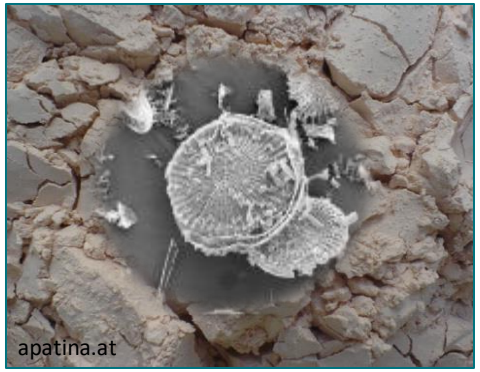
- Application of CMP on April 11, 2022; incorporation with cultivator
- 1% amendment (P 1.0) in 0-20 cm: 2.8 kg CMP m^2
- Soil sampling on April 20
- Sowing of *Zea mays* L. on May 02
- Fertilization according to conventional agricultural practice
- Plant harvesting and soil sampling on August 26






From powder to pellets

Pure CMP

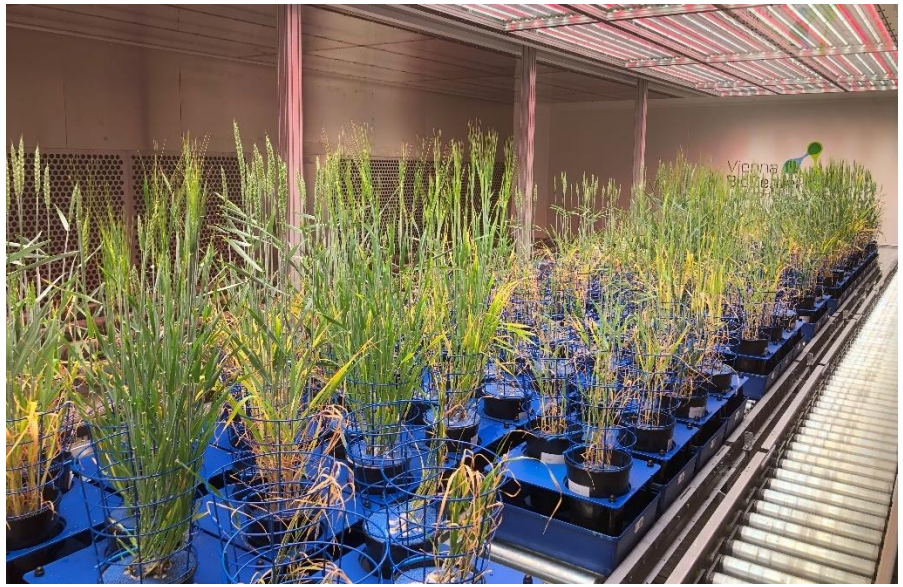


CMP with silicon-rich residues

CMP with organic residues

(c) Assessing the effect of CMP on water availability and drought stress mitigation in in the PHENOPlant facility at VBC

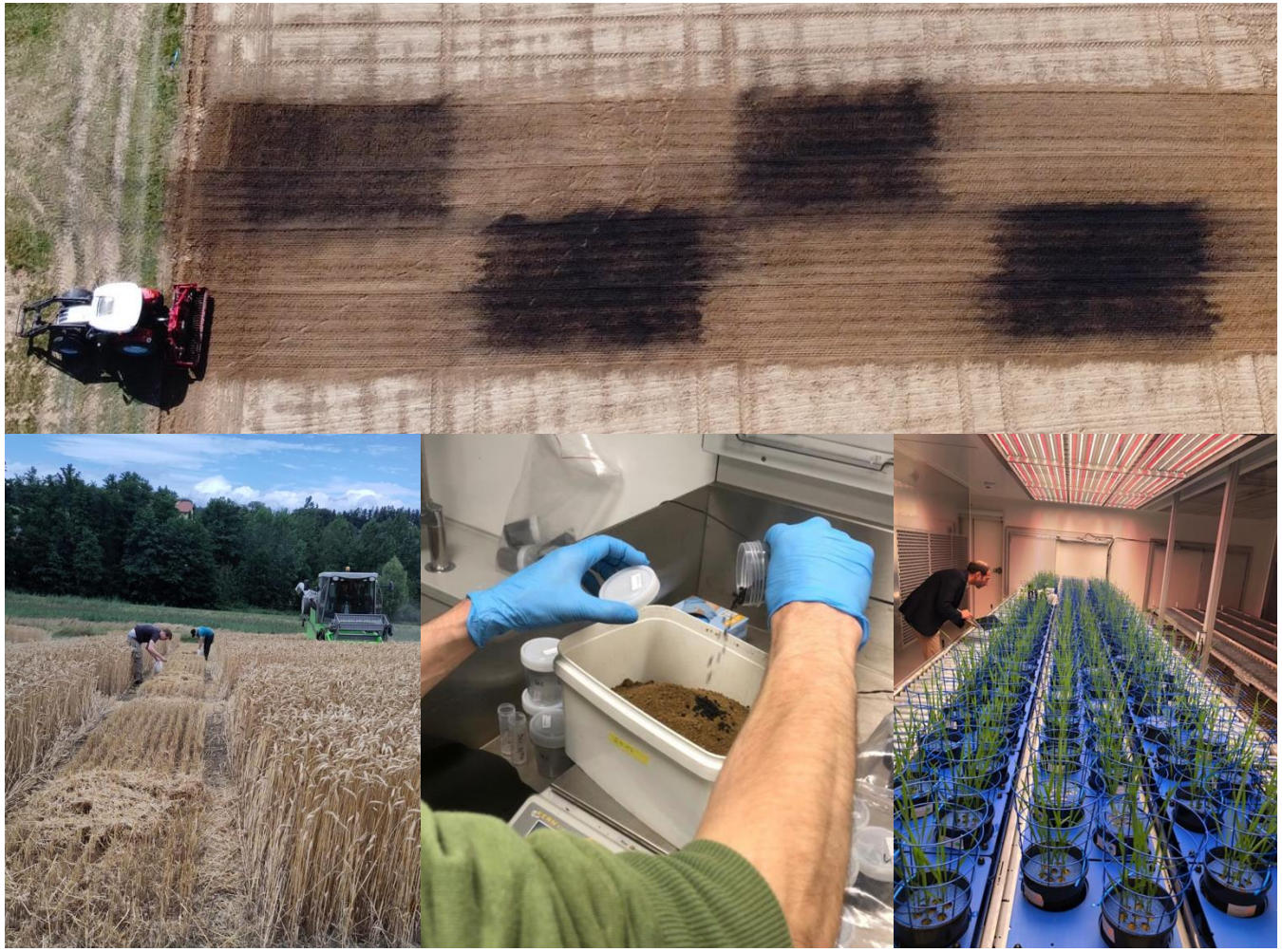



Assessing the effect of CMP on water availability and drought stress mitigation in in the PHENOPlant facility

- 1% CMP amendment in 2 mm-sieved Grabenegg soil
- Sufficent water supply vs. drought stress (starting 10 days after sowing)
- 7 weeks growth period (April – May 2023)
- RGB imaging; thermal imaging, hyperspectral imaging chlorophyll fluorescence
- Biomass production; nutrient content in biomass, soil fertility indicators

Beneficial effects of carbon from methane plasmalysis on soil conditions and plant growth: Conclusions



- CMP improves nutrient and water availability in soil
- CMP enhances plant growth under drought conditions
- CMP pellets have a great potential to be applied as soil conditions at large scale in pelletized form
- To do's: assessment of long-term effects and long-term stability

Acknowledgements







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