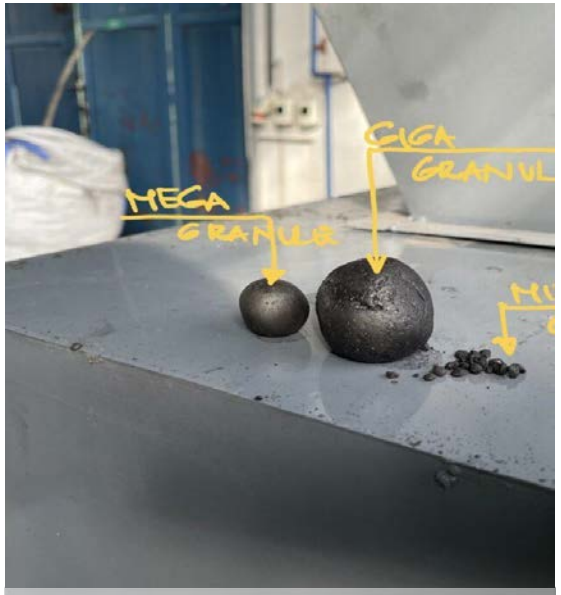

MICROCHAR AN ORGANIC BIOWASTE USED TO REMEDIATE AGRICULTURAL DROUGHT SOIL AND INCREASE BIOMASS GROWTH

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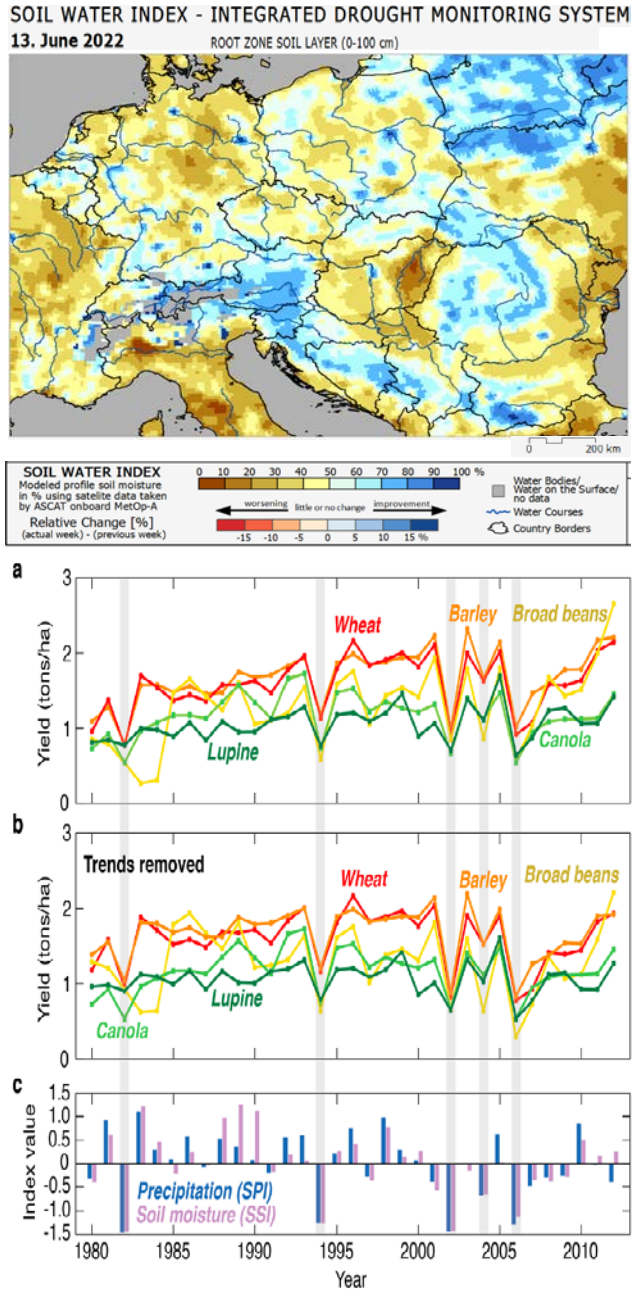
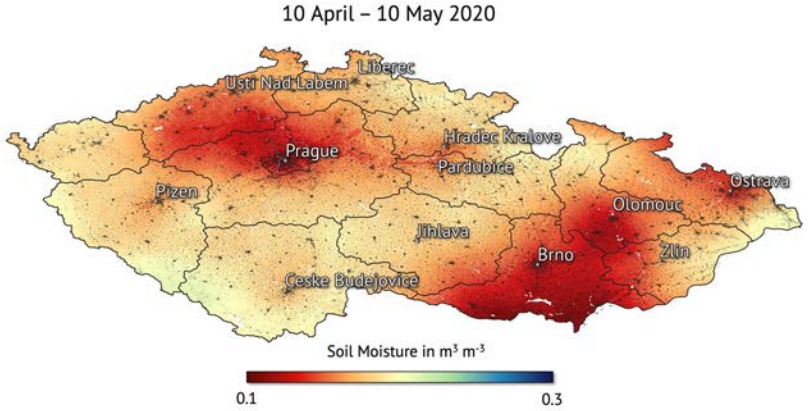
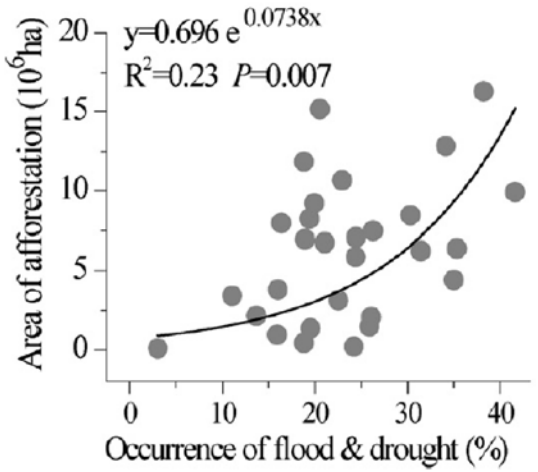
DROUGHT A CURRENT ISSUE IN EUROPE

- Extreme temperature conditions in Europe from 2014 and still being realized
- 6-year monitoring, with some areas showing 30% decline in moisture.
- Reduction in precipitations showed to reduced crop yield (Madadgar et al., 2017) and increase afforestation (Zhang et al., 2016)
- ENVIRONMENTAL & ECONOMICAL IMPACT







(EUROPEAN SPACE 2020) (HANEL, RAKOVEC ET AL. 2018) (MADADGAR, ET AL. 2017) (ZHANG ET AL. 2016)

HOW TO REMEDIATE THE SOIL - BIOCHAR

Biochar property:
pH: 11.12
N: 5.8 g/kg
P: 0.89 g/kg
K:3.9 g/kg

Biochar

- Reduce CO_2 emissions
- Increase soil water retention
- Reduce fertilizer requirement
- Increase crop production
- High stability in soil
- Enhance microbial activity

MicroChar property:
pH: 7.02
N: 0.54 g/kg
P: 0.45g/kg
K: 9.28 g/kg

MicroChar

- A biowaste product
- Granule size
- Easy to apply

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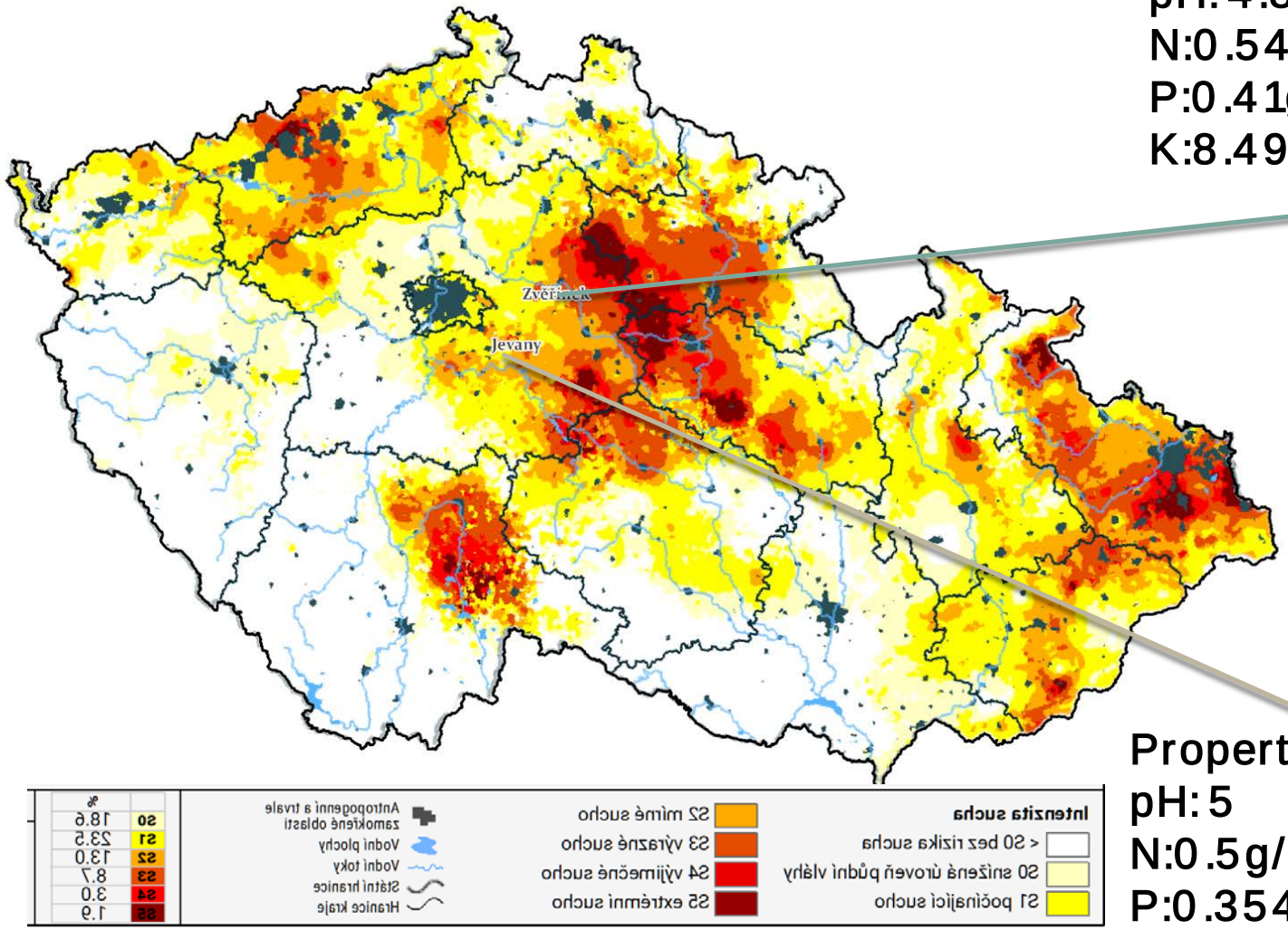
MicroCHAR organické hnojivo

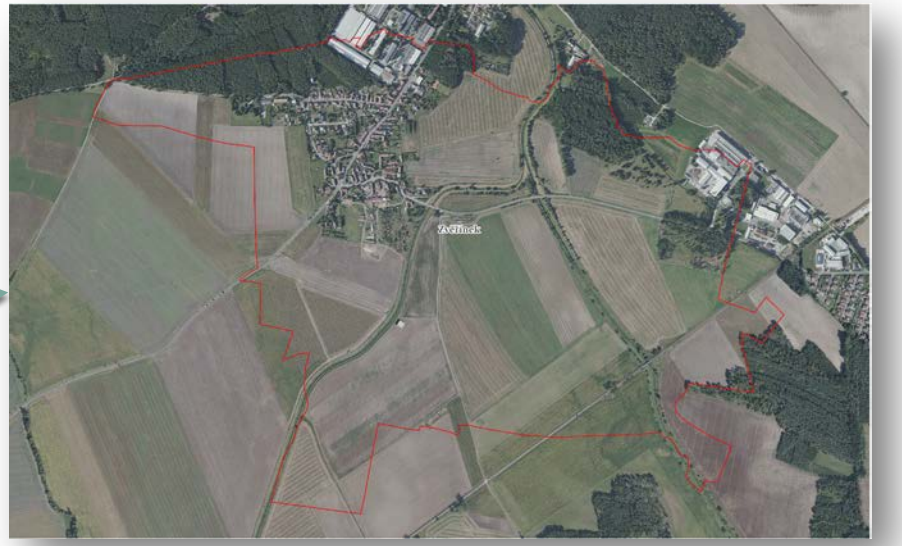
SOILS OF INTEREST



(INTERSUCH 2022)

Property:
pH: 4.80
N: 0.54 g/kg
P: 0.41 g/kg
K: 8.49 g/kg

Zverinek: Regosol soil



Property:
pH: 5
N: 0.5 g/kg
P: 0.354 g/kg
K: 22.239 g/kg

Jevany: Forest soil

20 WEEK INCUBATION EXPERIMENT

Treatments "amendments"	
RC	Regosol (Zvěřínek) (Control)
RM2%	Regosol (Zvěřínek) + 2 % microChar
FC	Forest soil (Jevany) (Control)
FM2%	Forest soil (Jevany) + 2 % microChar

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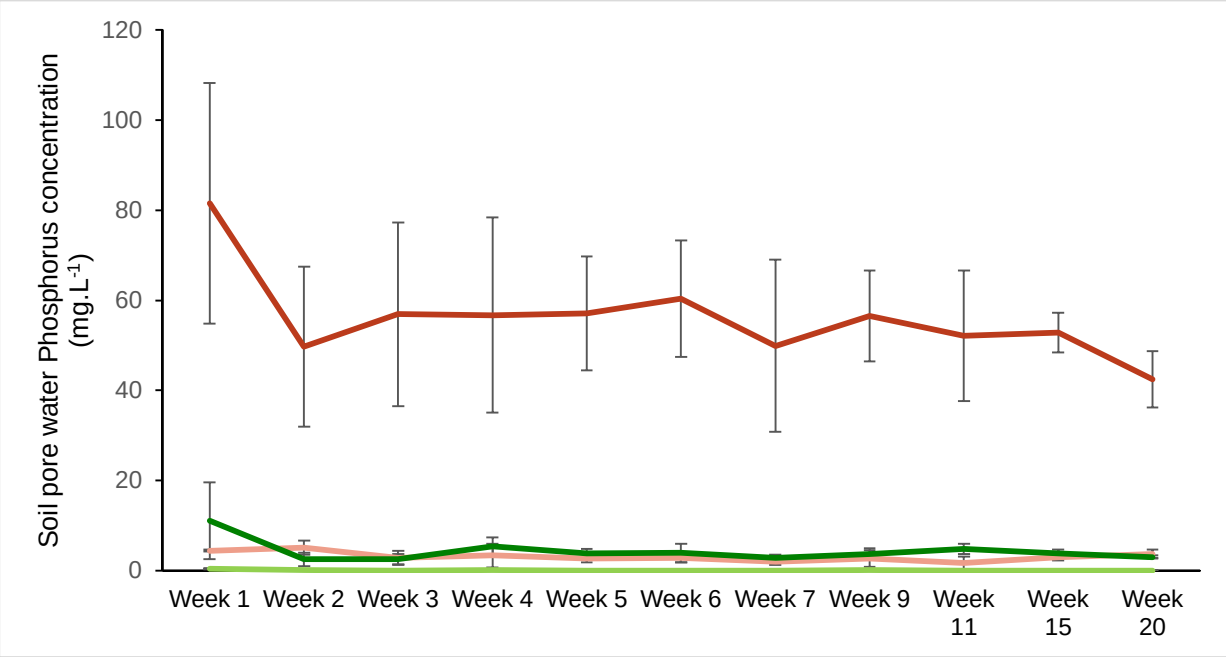
INCUBATION EXPERIMENT

- Test the effects of microChar on nutrient mobility.
- Evaluate and select which soil was best responsive to microchar, for a further pot experiment
- Soil Pore-water analysis: pH, EC, total elements

MACRO-NUTRIENTS

Phosphorus

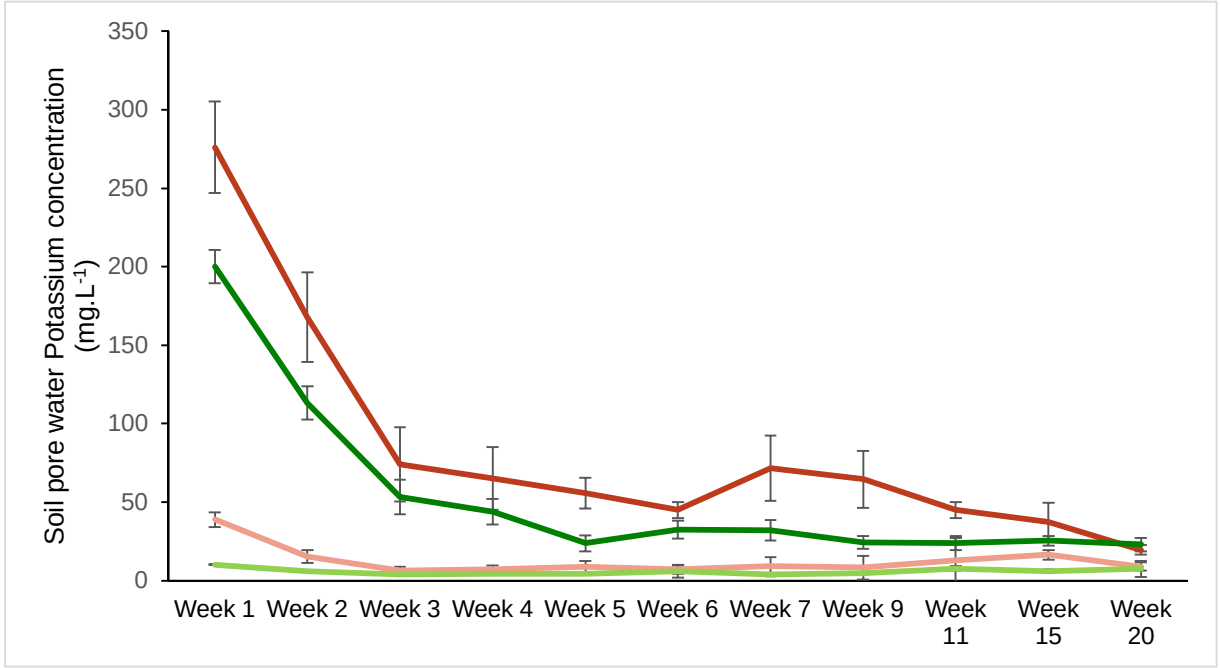
- Regosol > Forest soil
- Forest soil: no effect
- Regosol: 20-times increase of P mobility



RC – Regosol Control
RM2% - Regosol + MicroChar 2%
FC – Forest Soil Control
FM2% - Forest Soil + MicroChar 2%

Potassium

- Regosol > Forest soil (week 1)
- Forest soil: 20-times increase in week 1, lower increase with time (2-times)
- Regosol: 7-times increase in week 1, lower increase with time (3-times)



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POT EXPERIMENT

Experimental design	
Variant	**Treatment description**
CC	No amendment; Regosol
B	Regosol; Biochar (2%)
H	Regosol; Hoagland (5%)
FB	Regosol; MicroChar (2%)
FB-S	Regosol; MicroChar (2%) + Hoagland (H) Spike 5%

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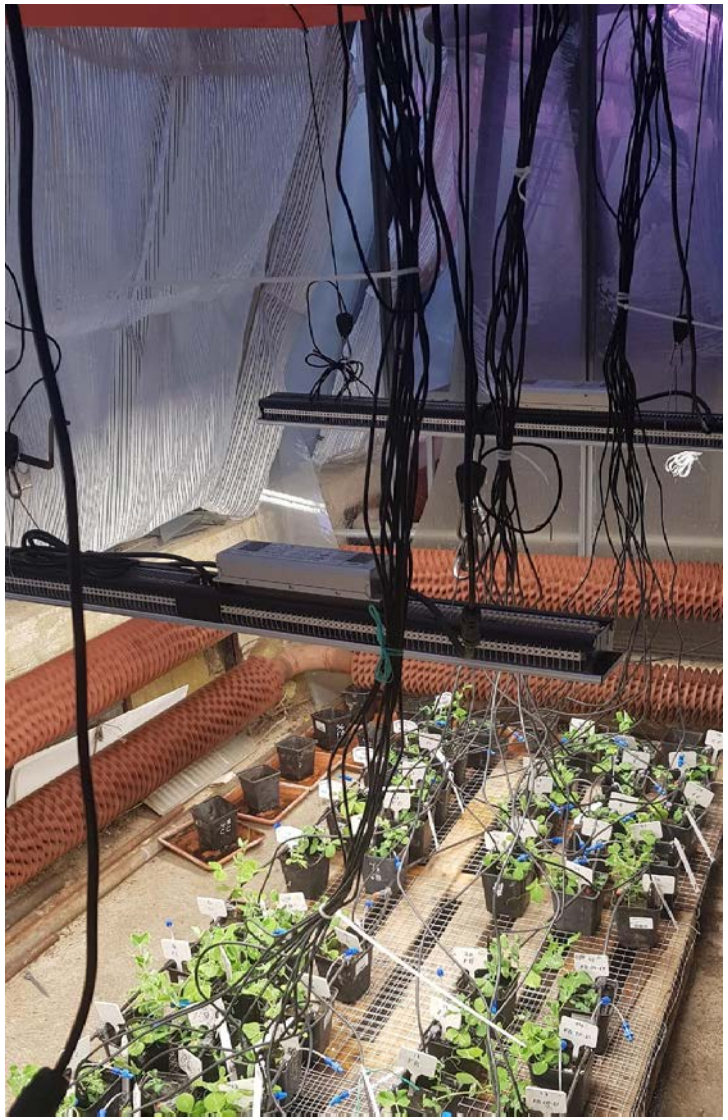


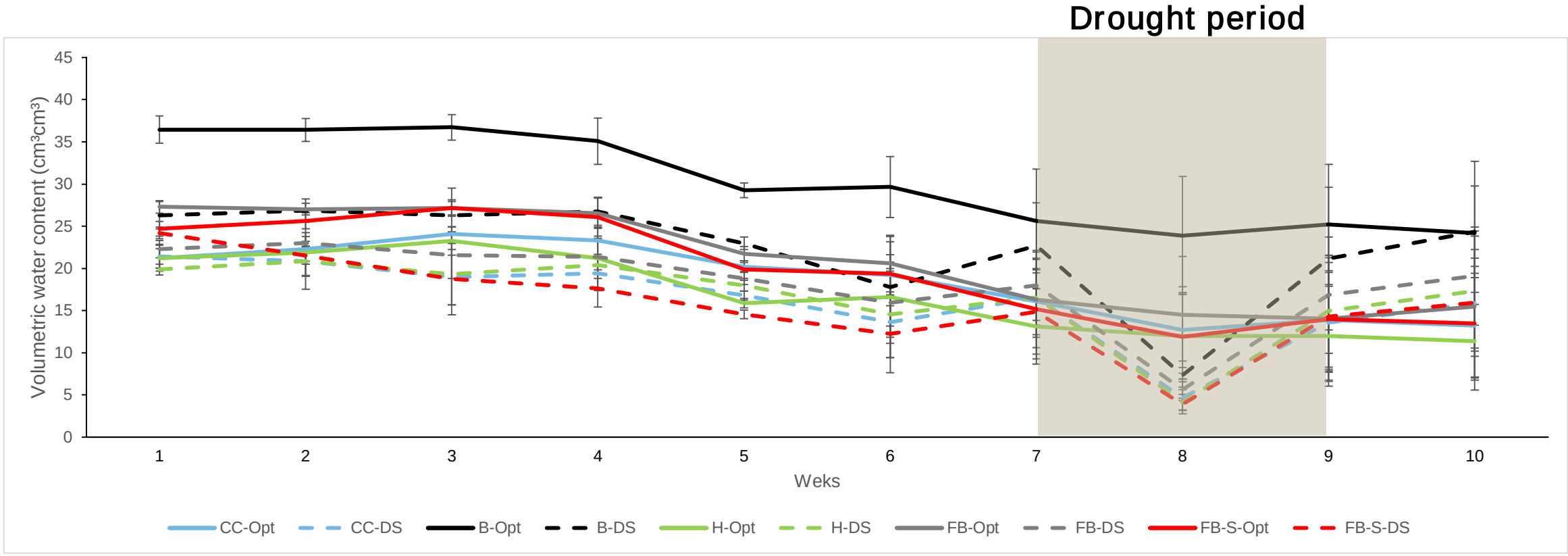
POT EXPERIMENT

- 70 – 80 Days
- Watering settings: regular watering for 6 weeks, reduced watering (30% of normal) for half the pots during 2 weeks, then back to normal
- Pore-Water analysis – TOC, TN, ICP-OES, IC, Moisture sensors
- Biomass growth

Randomised Design				
Optimal Conditions		Stress Conditions		
6 B	8 B	20 FB	42 FB	39 H
21 FB-S	13 H	25 FB-S	27 CC	34 B
22 FB-S	36 H	41 FB	43 FB	29 CC
1 CC	23 FB-S	5 CC	32 B	49 FB-S
7 B	9 B	10 B	28 CC	50 FB-S
11 H	3 CC	46 FB-S	47 FB-S	35 B
2 CC	4 CC	14 H	33 B	40 H
16 FB	18 FB	31 B	48 FB-S	44 FB
17 FB	24 FB-S	15 H	37 H	45 FB
12 H	19 FB	26 CC	38 H	30 CC
Optimal Conditions			Stress Conditions	

SOIL MOISTURE

- Biochar optimal was higher at 60%
- There was a 50% increase in Biochar during the Drought Stress period.



CC – Control
B – Biochar
H – Hoagland
FB – MichroChar
FB-S -MicroChar + Hoagland

DS – Drought Stress
Opt – Optimal Conditions

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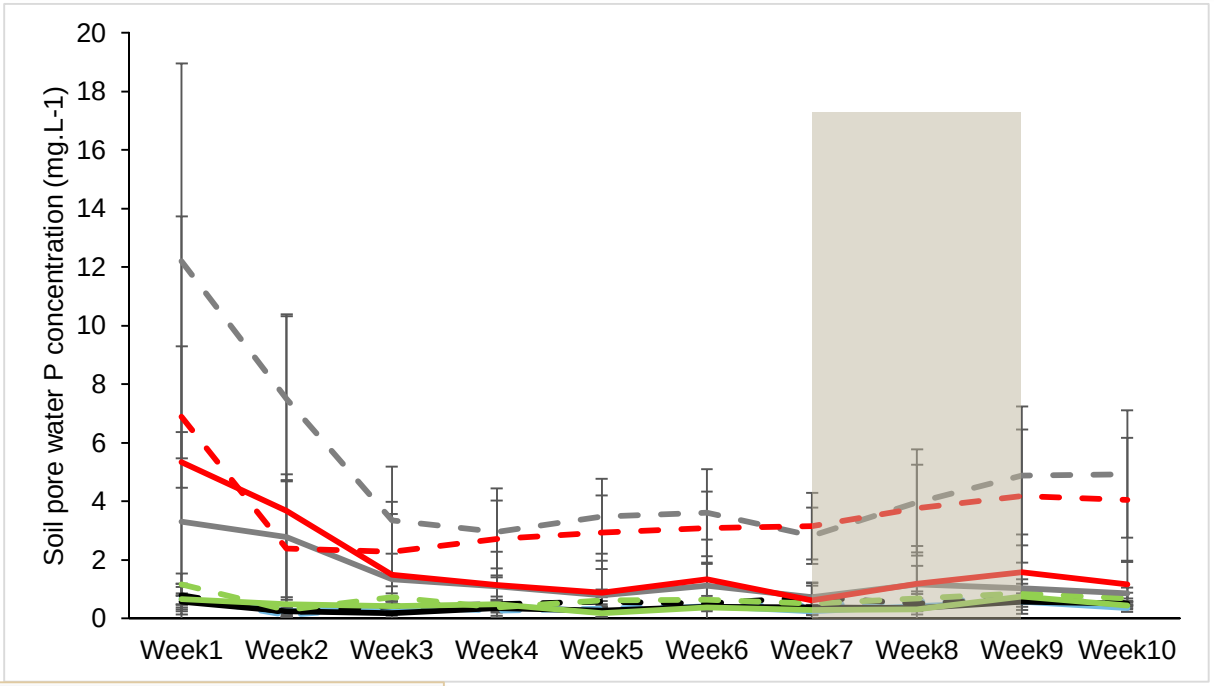
MACRO-NUTRIENTS

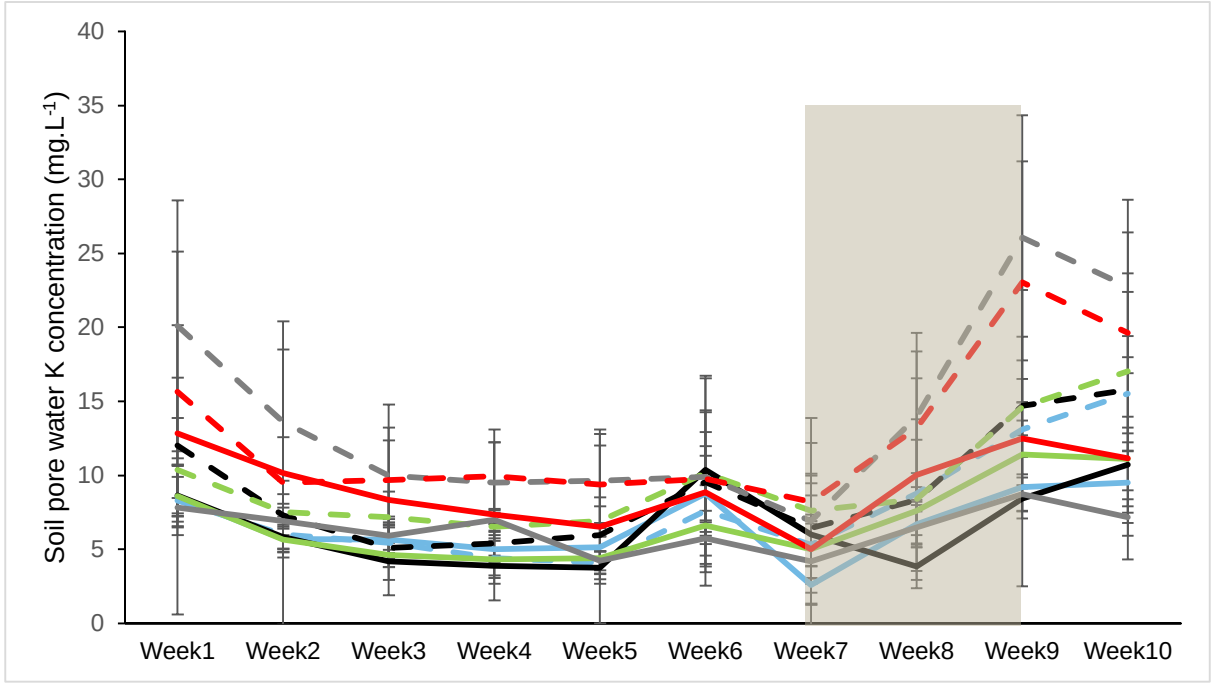
Phosphorus

- In week 1 & 2, FB increased 40-times and FB-S increased 14 –times.
- Week 3 -10 FB increased 9 -times, and FB-S increased 7-times
- Hence there was no need to add Hoagland.



Potassium

- An increase of 2-times mobility for FB and FB-S



CC – Control
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DS – Drought Stress
Opt – Optimal Conditions

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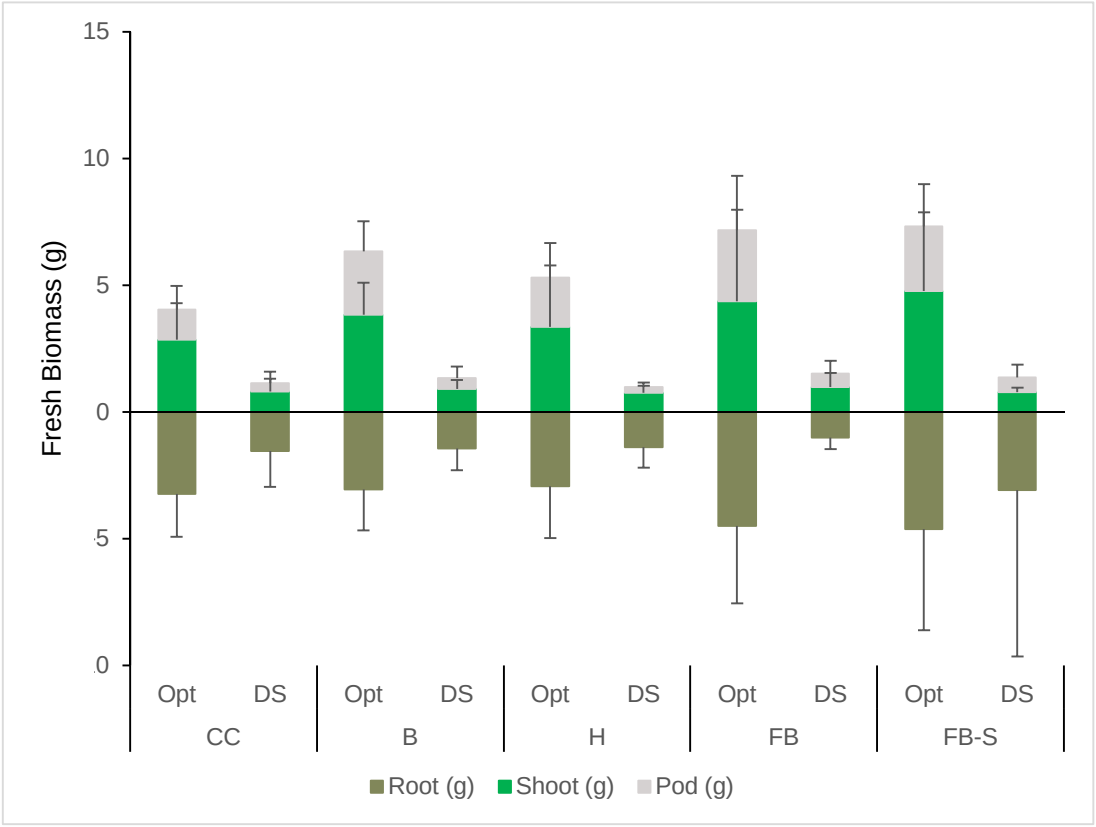
BIOMASS

- Optimal conditions FB and FB-S were the same with a 60% increase.
- In DS there was only an increase with FB-S, but this increase was mainly visible in roots and a slight increase in pods.



Root of FB-S

Shoot of FB-S

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Micro CHAR organické hnojivo

CONCLUSION

- MicroChar increased P, K mobility.
- MicroChar, increased plant growth and pod number compared to other treatments
- Spiking did not improve MicroChar effect.

PERSPECTIVES

- On going evaluation of stress response of plant
- Scaling up to the field experiment will be the next step.

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QUESTIONS

CZECH UNIVERSITY OF LIFE SCIENCES PRAGUE

KGEV
katedra geoenvironmentálních věd

THANK YOU!

Acknowledgement:

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