Dissolved soil organic matter as a fertility indicator in arable soils: How local conditions control its properties and implications for climate change

Presenter: *Thulfiqar Al-Graiti*

Authors: Thulfiqar Al-Graiti[1*], Gergely Jakab[1*], Zoltán Szalai[1*]

[1] *Department of Environmental and Landscape Geography, Institute of Geography and Earth Sciences, Faculty of Science, Budapest, Hungary, thulfiqar@student.elte.hu, jakab.gergely@csfk.org, szalai.zoltan@csfk.org*

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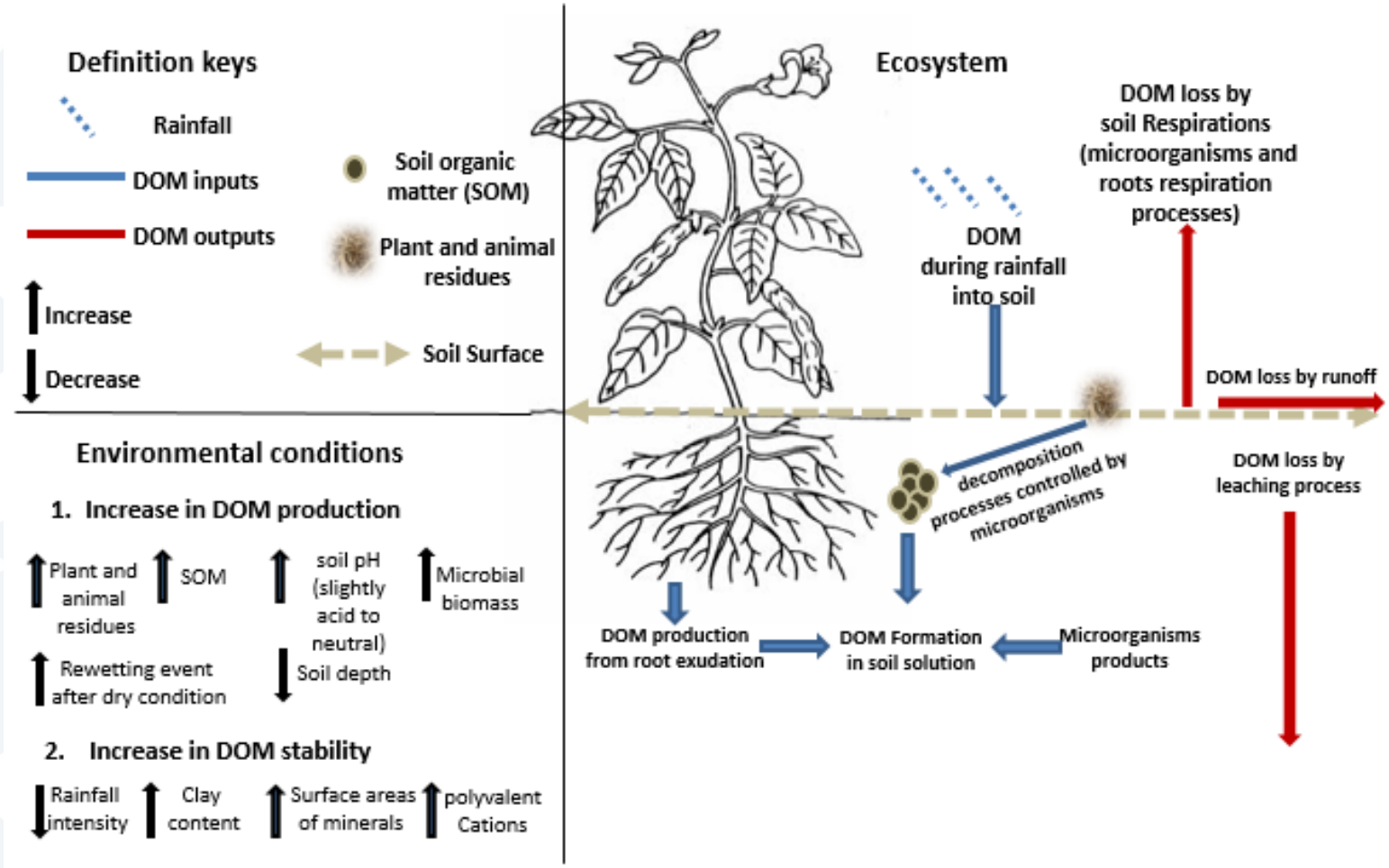
Background and the study importance

- Dissolved organic matter (DOM): Mobile, reactive, and mixture of organic molecules.
- Soil health indication (e.g., carbon (C) cycling and aggregation formation).

DOM inputs and outputs under certain environmental conditions



Aims and Objectives

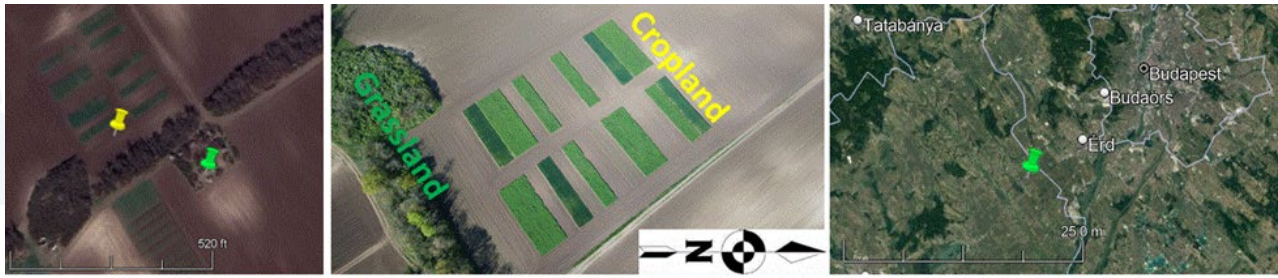
- This study aimed to elucidate sampling timing in conjunction with land-use effects on topsoil DOM in cropland and grassland sites.
- Our objective is to study sampling dates, site, and land-use impacts on DOM properties (composition and concentration).

➢Is DOM a robust property of the soil controlling fertility, or is it a sensitive soil quality index that can be affected by temporary (microbial) conditions?

✓We quantify dissolved organic carbon (DOC), total dissolved nitrogen (DN), C/N ratio, $SUVA_{254}$, fluorescence index (FI), biological index (BIX), and humification index (HIX) in arable soils.

Experimental Design

- Soil solution (1:10 soil/distilled water), shaken for 2 hours.



Study site's location and the long-term field trial near Martonvasar, Hungary (Google earth pro).

The Table showed experimental design and treatments addition in (kg/ha). A letter: no fertilization (Control), D letter: NPK (nitrogen (N) - 160 kg/ha/y), phosphorus (P) – 80 kg/ha/y, and potassium (K) – 80 kg/ha/y). B letter: NPK+manure (as an organic fertilizer – 40 t/ha/y) treatment.

Application date	Treatment	Maize			Wheat			Sampling Dates
		NH_4NO_3	P_2O_5	K_2O	N	P_2O_5	K_2O	
4/3/2018	A	-	-	-	-	-	-	3/29/2018
	B	-	-	-	50	-	-	5/23/2018
	D	-	-	-	56	-	-	6/26/2018
3/28/2019	A	-	-	-	-	-	-	-
	B	25	-	-	25	-	-	4/23/2019
	D	25	-	-	25	-	-	6/4/2019
10/11/2019	A	-	-	-	-	-	-	7/8/2019
	B	100	45	50	50	45	50	9/9/2019
	D	112	45	50	56	45	50	10/14/2019

Measurements

- Total organic carbon (TOC).
- Total Nitrogen (TN).
- Inorganic carbon (IC).

Shimadzu TOC-L instrument

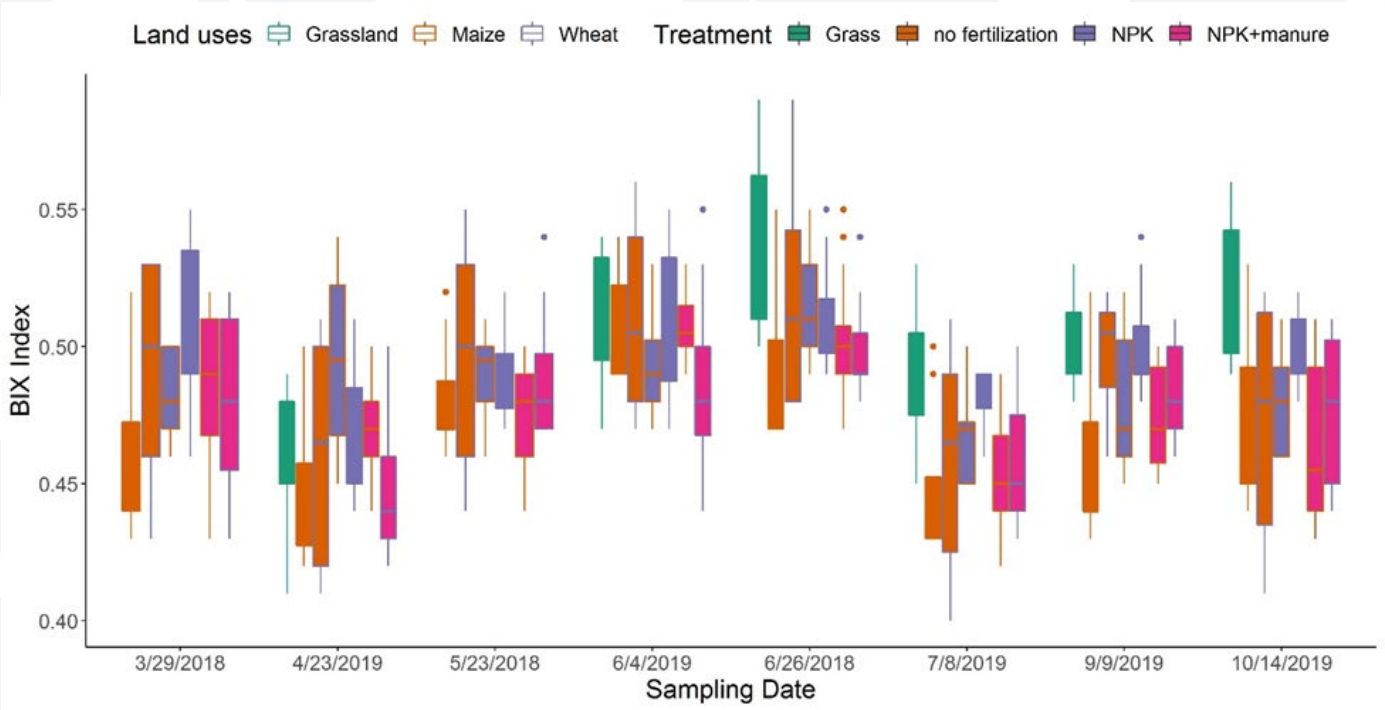
- Fluorescence measurement (Fluorescence index (FI); Biological index (BIX); Humification index (HIX); $SUVA_{254}$.

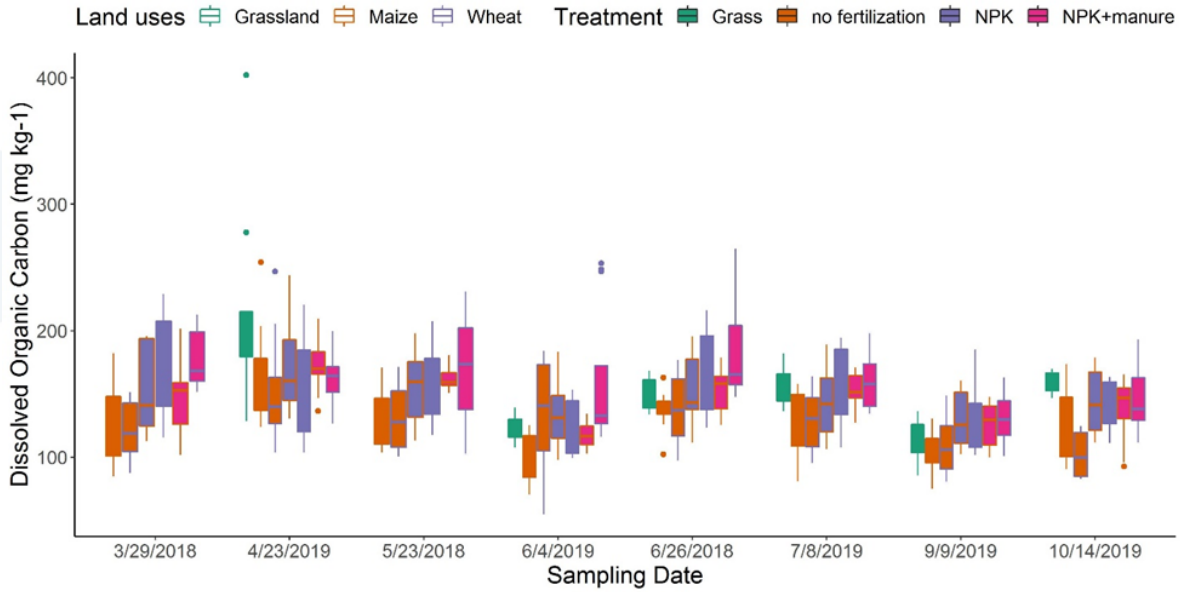
SpectroFluorophotometer-RF 6000

UV-VIS Spectrophotometer UV-2600i

Results and discussion

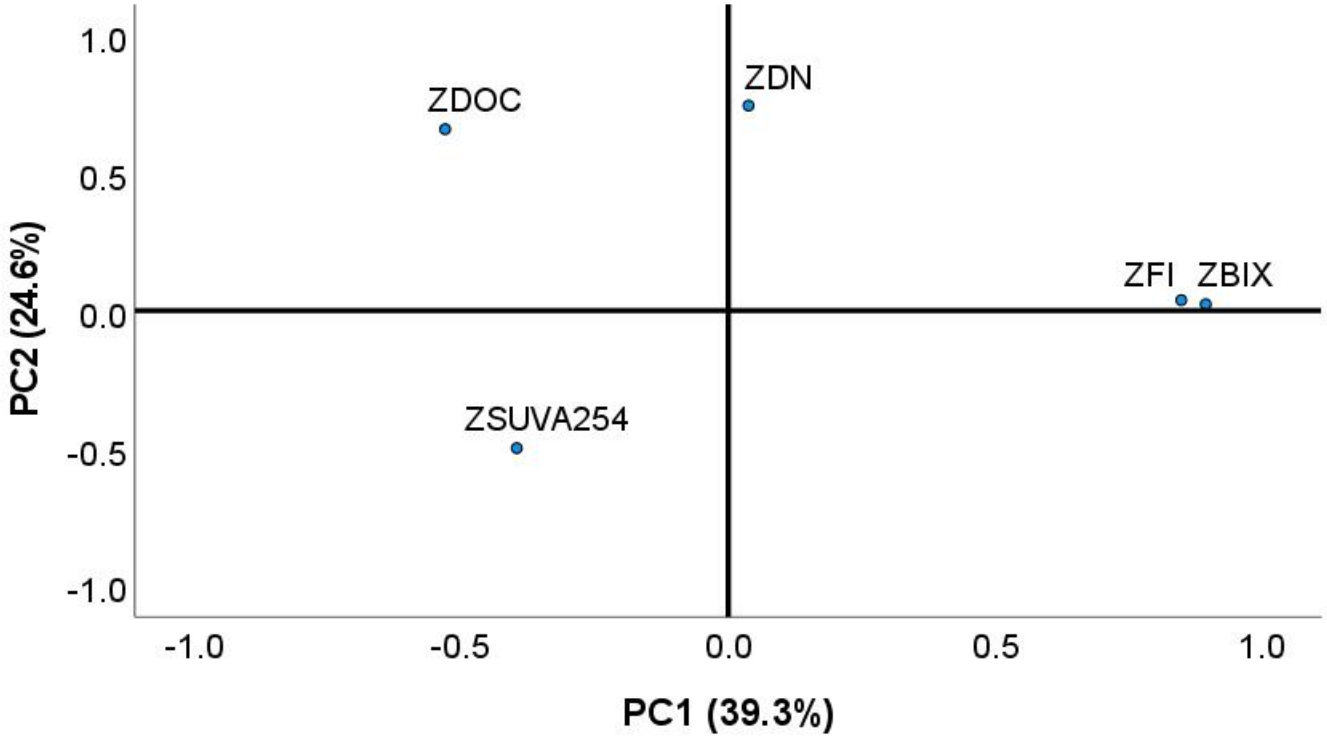
- Results visualization and represented by DOC concentrations and biological activities index.





Results and discussion

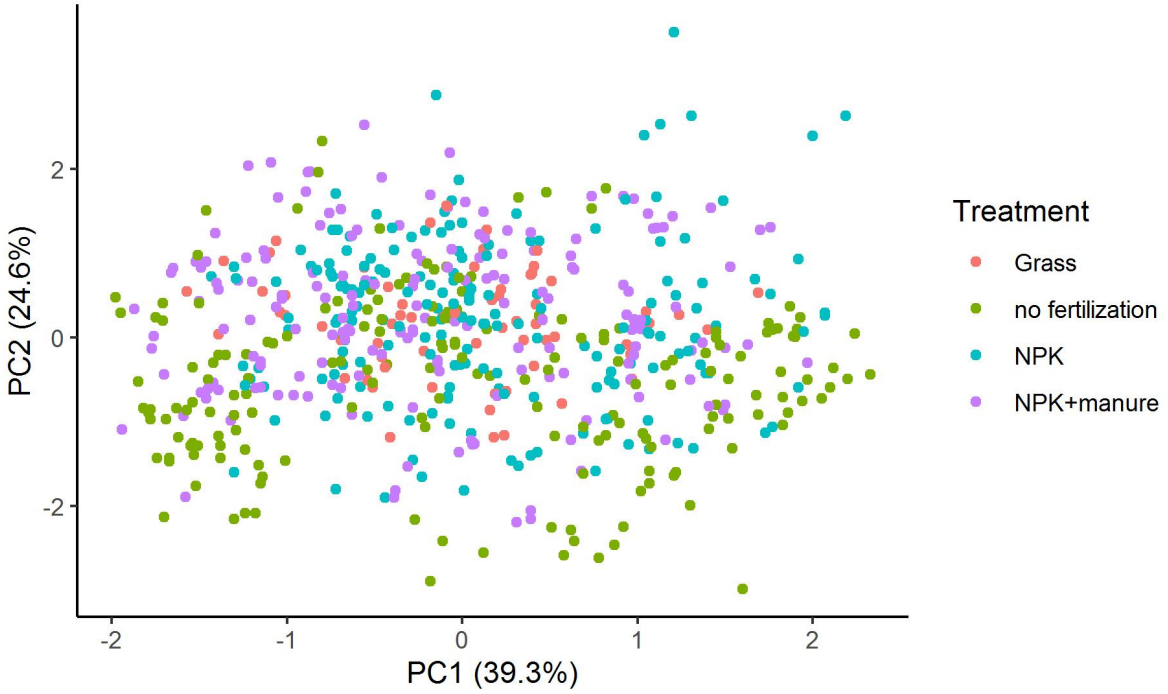
- Principle component results.



Study variables	Principal Component	
	PC1	PC2
Dissolved nitrogen (DN)	0.038	0.744
Dissolved organic carbon (DOC)	-0.530	0.658
$SUVA_{254}$	-0.396	-0.499
BIX index	0.894	0.023
FI index	0.848	0.038
Extraction Method: Principal Component Analysis.		
Rotation Method: Varimax with Kaiser Normalization.		

Discussion and conclusion

- No effect from land uses, including fertilizers and crop covers on DOM contents.
- Microbiological indices had a significant contribution, explaining DOM variance.
  - Include microbiome and microbial data in future studies.
- Develop a unified methodological procedure for DOM studies.
  - To ensure soil quality for food security and mitigate climate change in arable lands.



- Plotting scatter for the study components by treatments.


Thank you !
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