NENUPHAR
Nutrients recycling and pollution handling

VYTAUTAS MAGNUS UNIVERSITY

Monitoring the impact of Compost on Agricultural Soils and the Environment in Lielupė River basin (*WP5*)

Monitoring ativities in Lithuania -2025

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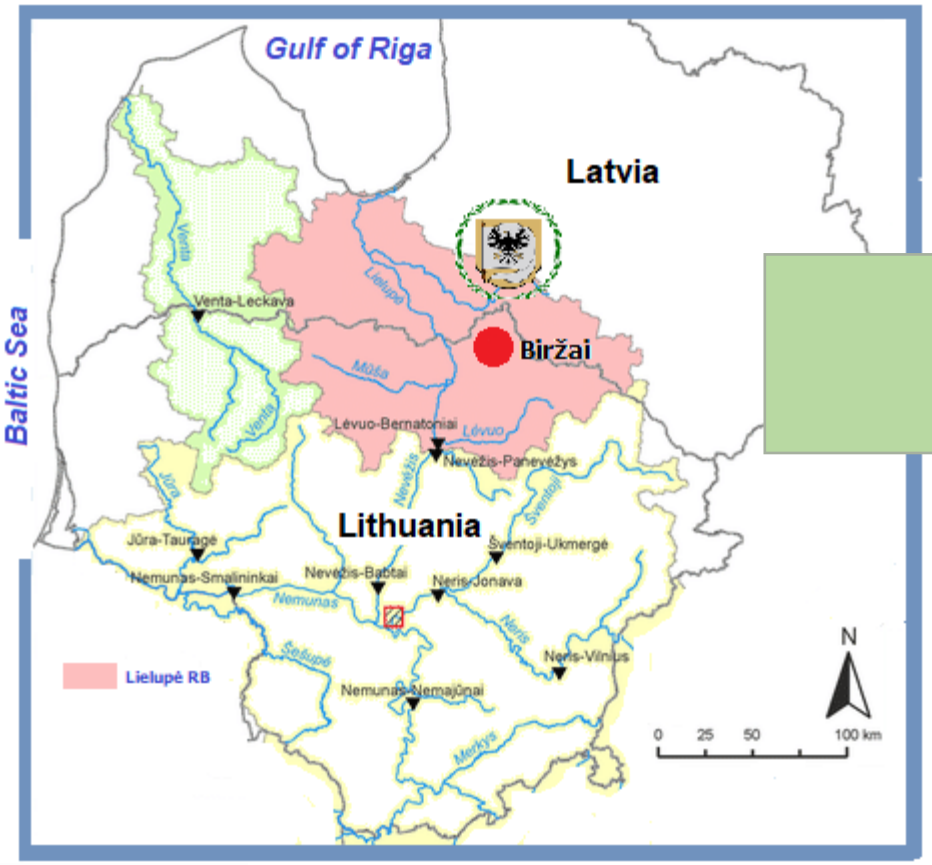
Linas Jurevičius, Martynas Žiūrys

February 24, 2026
Ceraukste village, Latvia

Co-funded by the European Union

Sites selection



Demo (monitoring) sites

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Agricultural fields

Tile drainage systems & soil sampling sites

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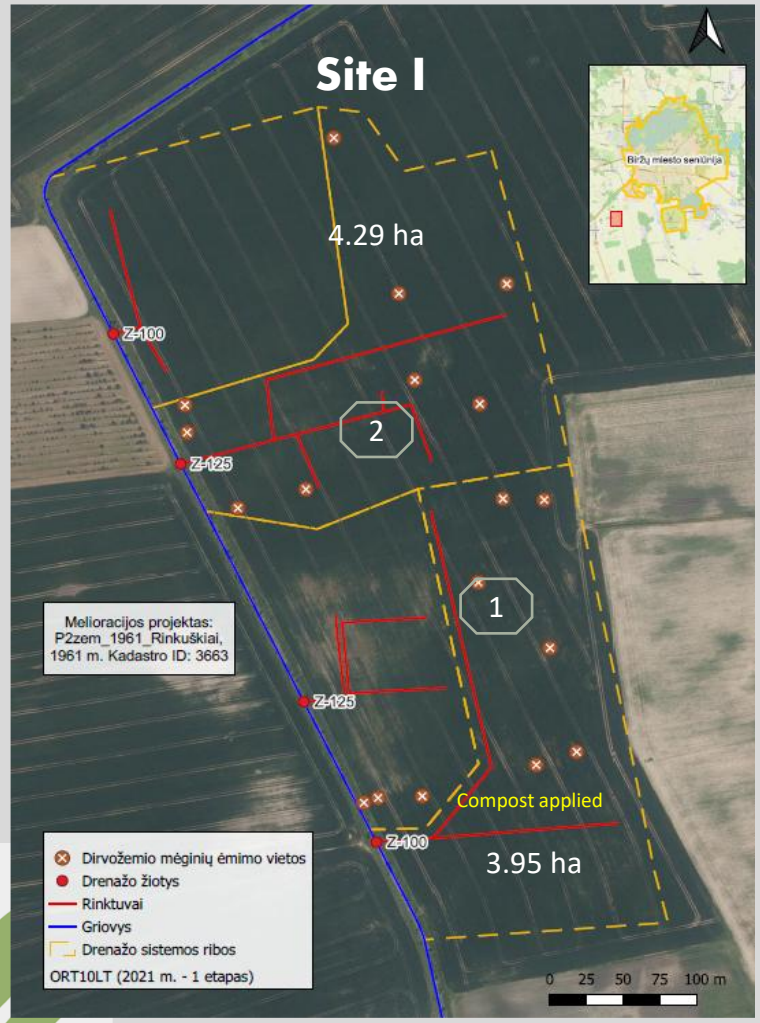

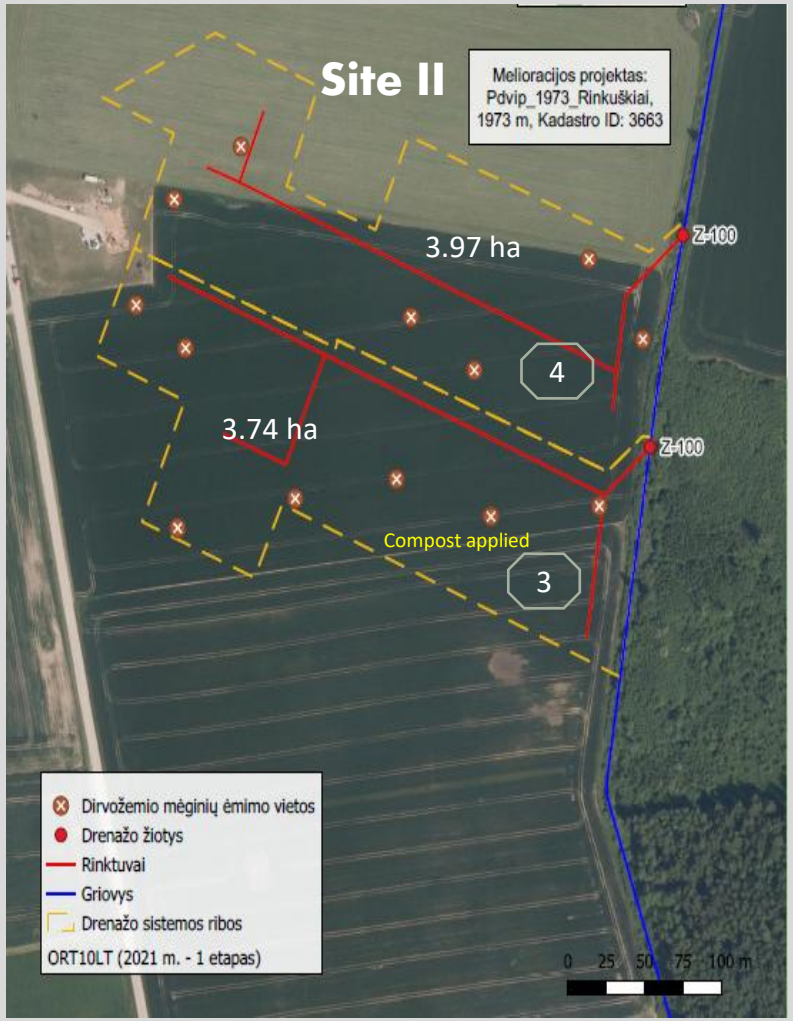

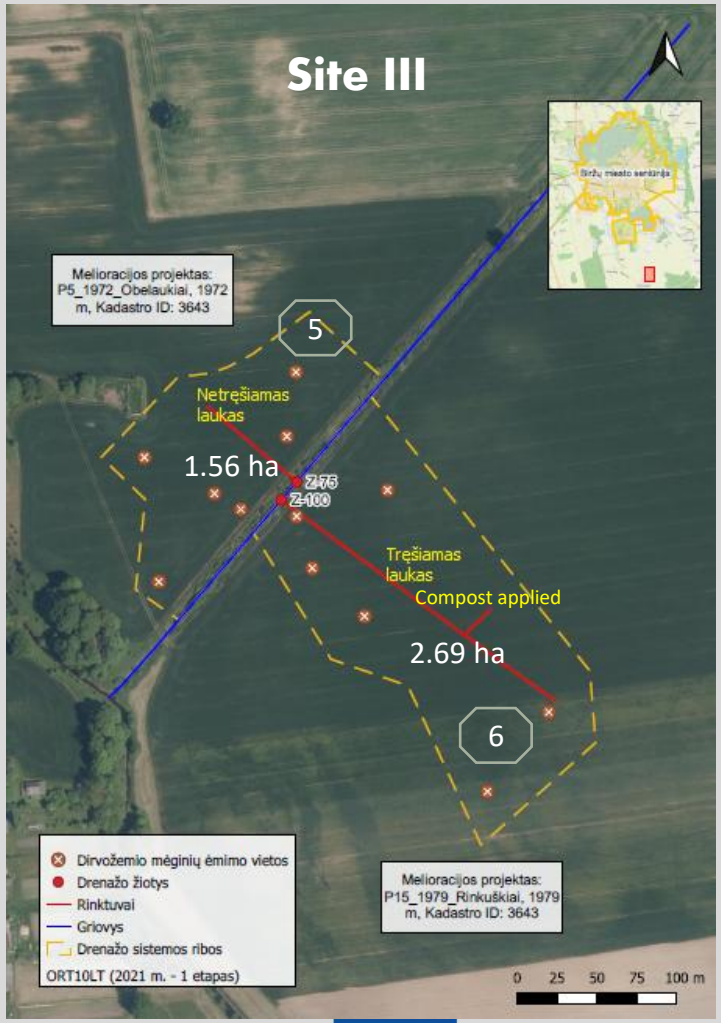

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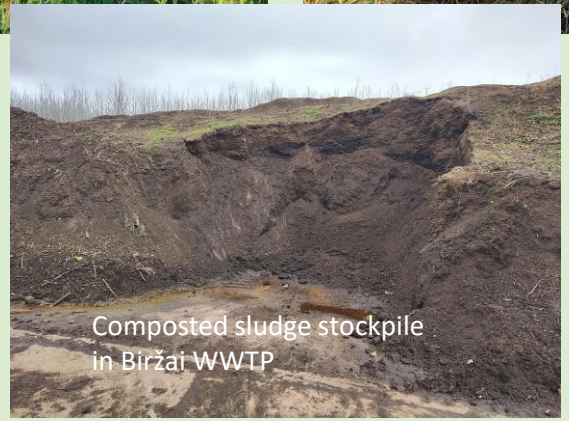
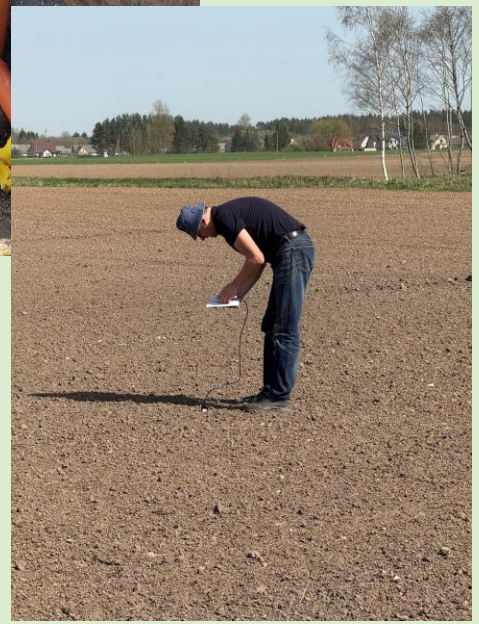
Work milestones up to November 19, 2024 (start of monitoring)



Composted sludge stockpile in Biržai WWTP



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Soil textural and chemical composition

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Soil composite samples

Field No.	Texture
1-2	Loamy sand
3-4	Loamy sand/sandy loam
5-6	Loamy sand

Tyrimo rezultatai:

Ėminio kodas	Užsakovo informacija apie ėminį*		Tyrimo parametrai ir rezultatai (x±U)** Nutrients								
	Ėminio Nr. Field No.	Paėmimo vieta	pH 1 mol/KCl suspensijoje ***	Judriojo fosforo (P_2O_5) koncentracija mg/kg ***	Judriojo kalio (K_2O) koncentracija mg/kg ***	Bendro fosforo (P) koncentracija mg/kg ****	Bendro kalio (K) koncentracija mg/kg ***	Azoto (nitratinio plius nitritinio suma) koncentracija mg/kg ***	Azoto (amoniakinio) koncentracija mg/kg ***	Mineralinio azoto koncentracija mg/kg ***	Bendro azoto (N) koncentracija %***
D 31SI-1	1	Biržų r. Nr.1	7,4	158	110	434	3499	9,55	3,37	12,92	0,241
D 31SI-2	2	Biržų r. Nr.2	7,2	175	139	450	2749	21,81	2,09	23,90	0,214
D 31SI-3	3	Biržų r. Nr.3	7,2	430	260	613	3041	19,73	1,52	21,25	0,143
D 31SI-4	4	Biržų r. Nr.4	7,4	309	227	534	3208	16,30	2,06	18,36	0,170
D 31SI-5	5	Biržų r. Nr.16 (5)	7,1	205	160	468	1449	14,39	1,48	15,87	0,181
D 31SI-6	6	Biržų r. Nr.24 (6)	6,8	206	156	480	1333	10,91	1,93	12,84	0,154
Tyrimų atlikimo data:			2024-08-28			2024-09-02		2024-08-29			2024-08-29

Ėminio kodas	Užsakovo informacija apie ėminį*		Tyrimo parametrai ir rezultatai (x±U)** Heavy metals							
	Ėminio Nr. Field No.	Paėmimo vieta	Kadmio (Cd) koncentracija mg/kg ****	Nikelio (Ni) koncentracija mg/kg ****	Švino (Pb) koncentracija mg/kg ****	Chromo (Cr) koncentracija mg/kg ****	Vario (Cu) koncentracija mg/kg ****	Cinko (Zn) koncentracija mg/kg ****	Gyvsidabrio (Hg) koncentracija mg/kg ****	Organinė medžiaga % Organic Matter
D 31SI-1	1	Biržų r. Nr.1	0,25	14,0	13,10	16,9	7,7	27,1	0,046	6,44
D 31SI-2	2	Biržų r. Nr.2	0,24	12,8	11,00	12,0	5,80	22,9	0,037	5,49
D 31SI-3	3	Biržų r. Nr.3	0,20	12,20	12,80	12,2	6,83	28,9	0,028	3,77
D 31SI-4	4	Biržų r. Nr.4	0,23	12,4	24,30	14,5	7,2	25,6	0,035	4,65
D 31SI-5	5	Biržų r. Nr.16 (5)	0,23	14,6	8,80	26,7	5,70	21,9	0,035	4,59
D 31SI-6	6	Biržų r. Nr.24 (6)	0,23	10,80	8,83	10,5	5,30	24,5	0,027	3,16
Tyrimų atlikimo data:			2024-09-04				2024-08-29		2024-08-29	2024-09-09

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LIETUVOS AGRARINIŲ IR MIŠKŲ MOKSLŲ CENTRO
ŽEMDIRBYSTĖS INSTITUTO
AGROCHEMINIŲ TYRIMŲ LABORATORIJA
ANALITINIS SKYRIUS

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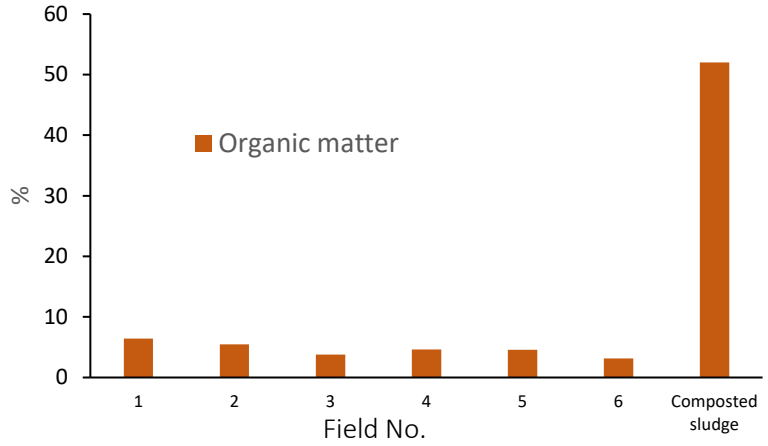
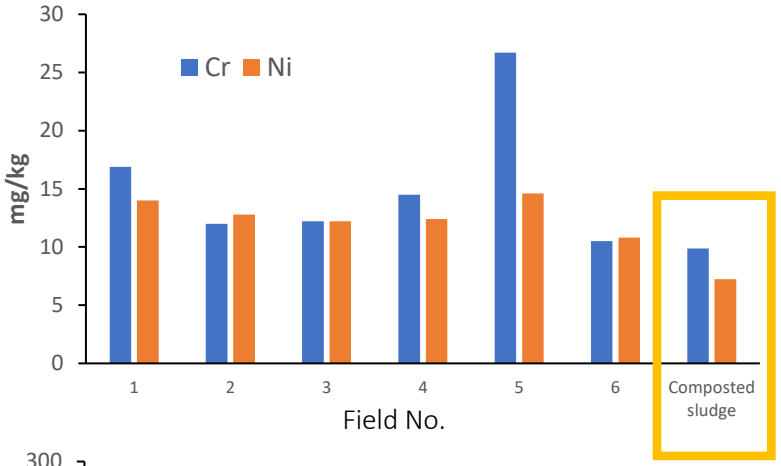
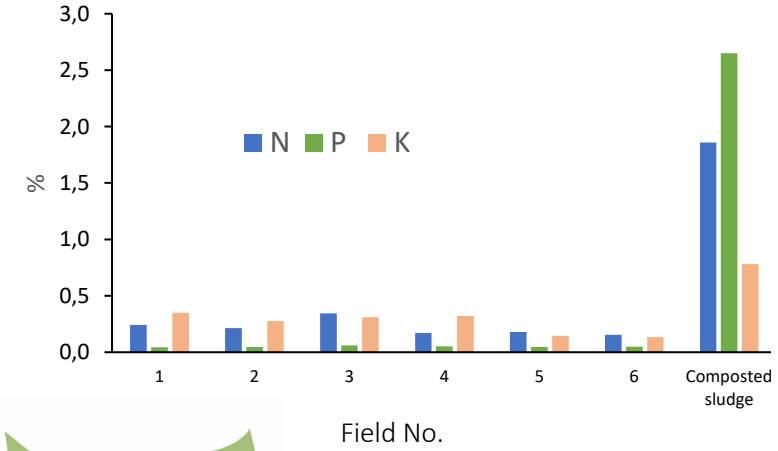
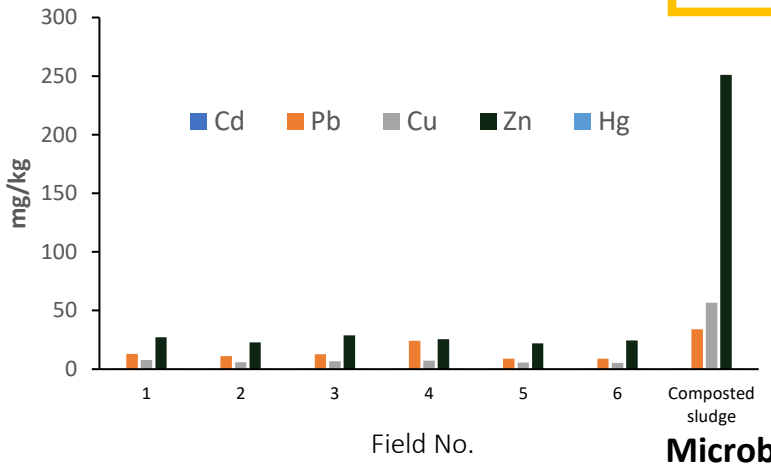
Chemical composition (composted sludge -2024)

Comparison of Substance Content in Soil and Composted Sludge









Composted sludge (CS)

Tyrimų parametras	Tyrimo rezultatai (x±U)**	MAC
pH	8,1±0,2	
Sausų medžiagų kiekis % **DM**	42,0±0,5	
Sausoje medžiagoje:		
Organinių medžiagų kiekis % **Organic Matter**	52,0±5,8	
Bendrojo (suminio) azoto (N) kiekis %	1,86±0,36	
Bendras fosforas (P_2O_5) %	2,65±0,061	
Bendras kalis (K_2O) %	0,78±0,03	
Kadmis (Cd) mg/kg	0,4 ±0,086	<2
Chromas (Cr) mg/kg	9,87±2,28	<70
Nikelis (Ni) mg/kg	7,23±2,49	<50
Švinas (Pb) mg/kg	33,9±5,52	<120
Varis (Cu) mg/kg	56,6±9,2	<300
Cinkas (Zn) mg/kg	251±37	<800
Gyvsidabris (Hg) mg/kg	<0,02***	<1

Microbiological indicators:

Clostridium perfringens count	<100000
Escherichia coli count	<1000
Helminth eggs and protozoan (oo) cysts	0
Presence of Salmonella spp.	0

(Amendments by Order No. D1-713 from November 24, 2020)

MAC – maximum allowable concentration

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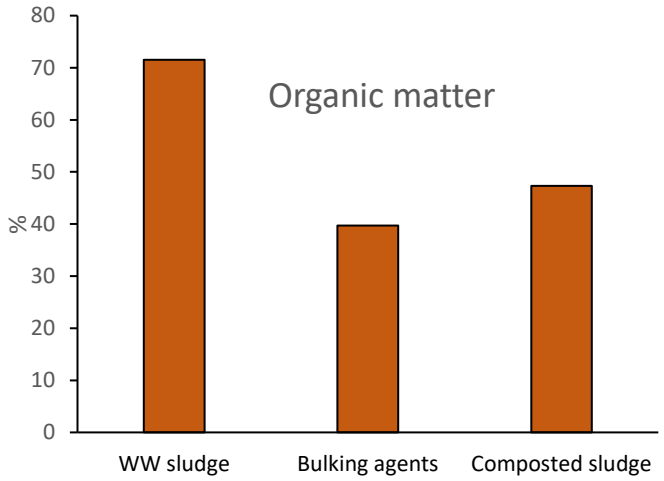
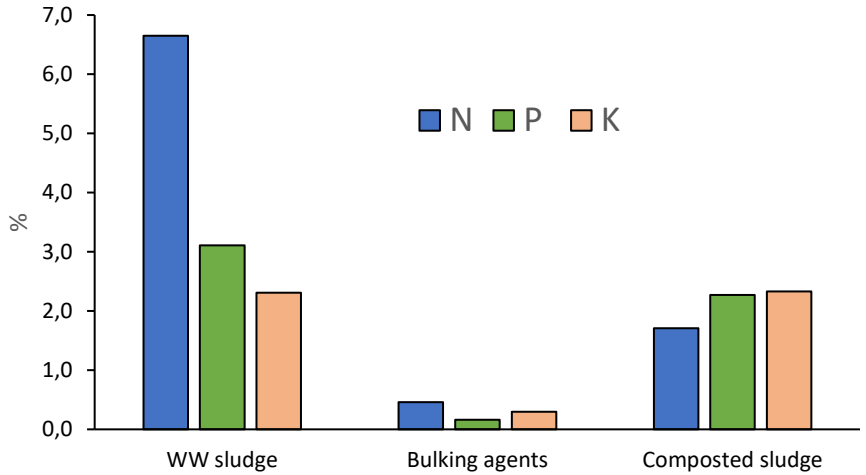
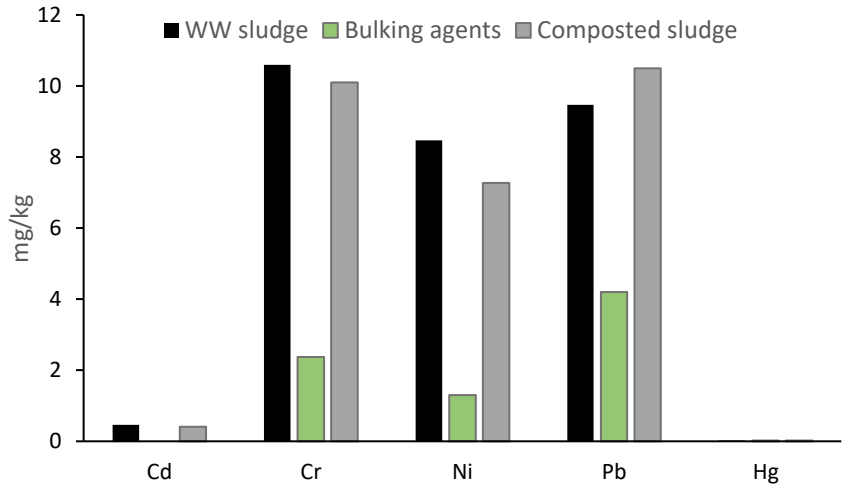
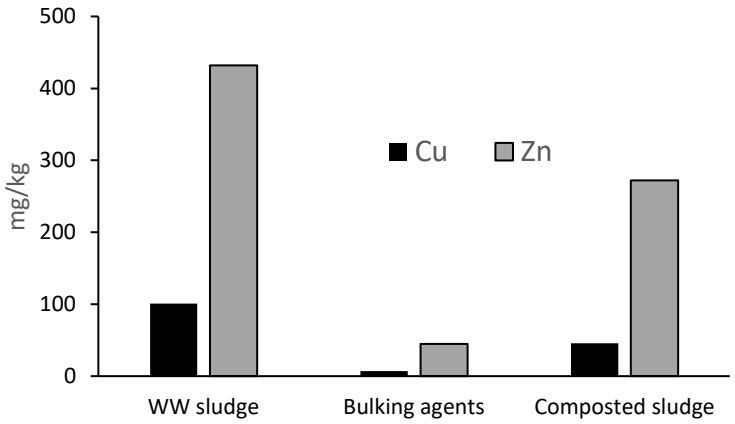
Chemical composition of composted sludge (2025)









WW Sludge + **Bulking agents** = **Composted sludge**

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Activity timeline for 2025

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January-present

- Continuous Water Quantity and Quality monitoring;

April 17-18

- **Beans** sown in Demo fields II

May 28

- **Samples of soil** from all demo sites, along with composted sludge, were sent to CIRCE for **laboratory study** (Paula)

Note: Due to **severely wet** conditions during the first decade of August (after harvesting) at **Demo site I compost application was not possible!**

Aug 9- Sept 7

- **Harvesting** in Demo fields I (August 9) and III (winter wheat);

- **Collection of samples** for chemical analysis of grains and straw;

- **White mustard** sown in Demo fields III

- **Winter rapeseed** sown in Demo fields I (August 18)

- **Harvesting** in Demo fields II (beans). Collection of samples for bean grain and stems.

Sept. 5-28

- **Spreading of composted sludge 25-30 t/ha in Demo fields II and III;**

-**Winter wheat sown in Demo fields II.**

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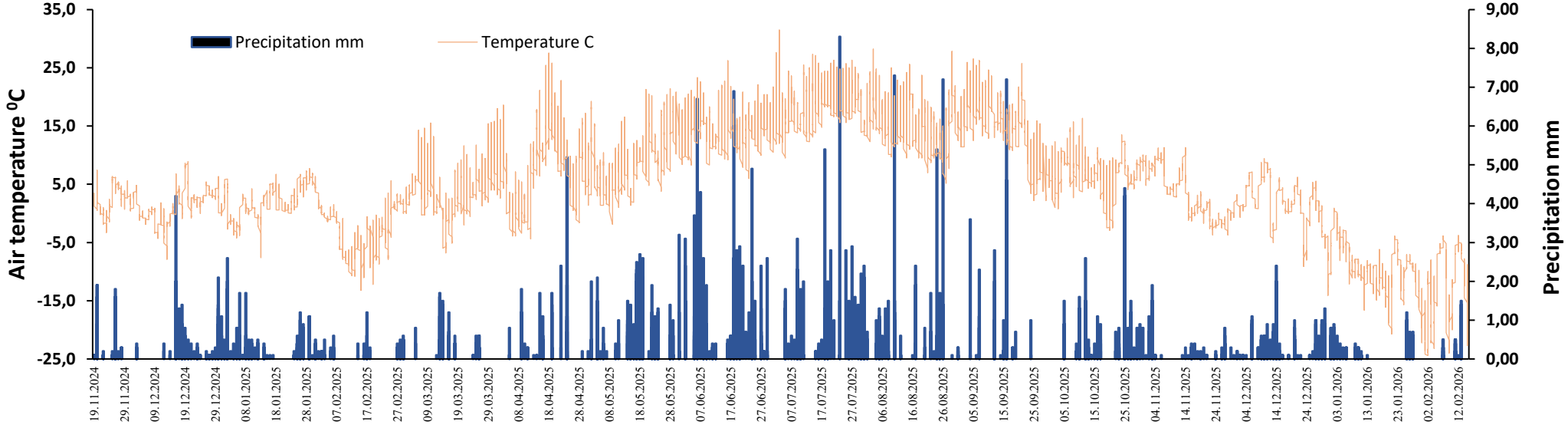
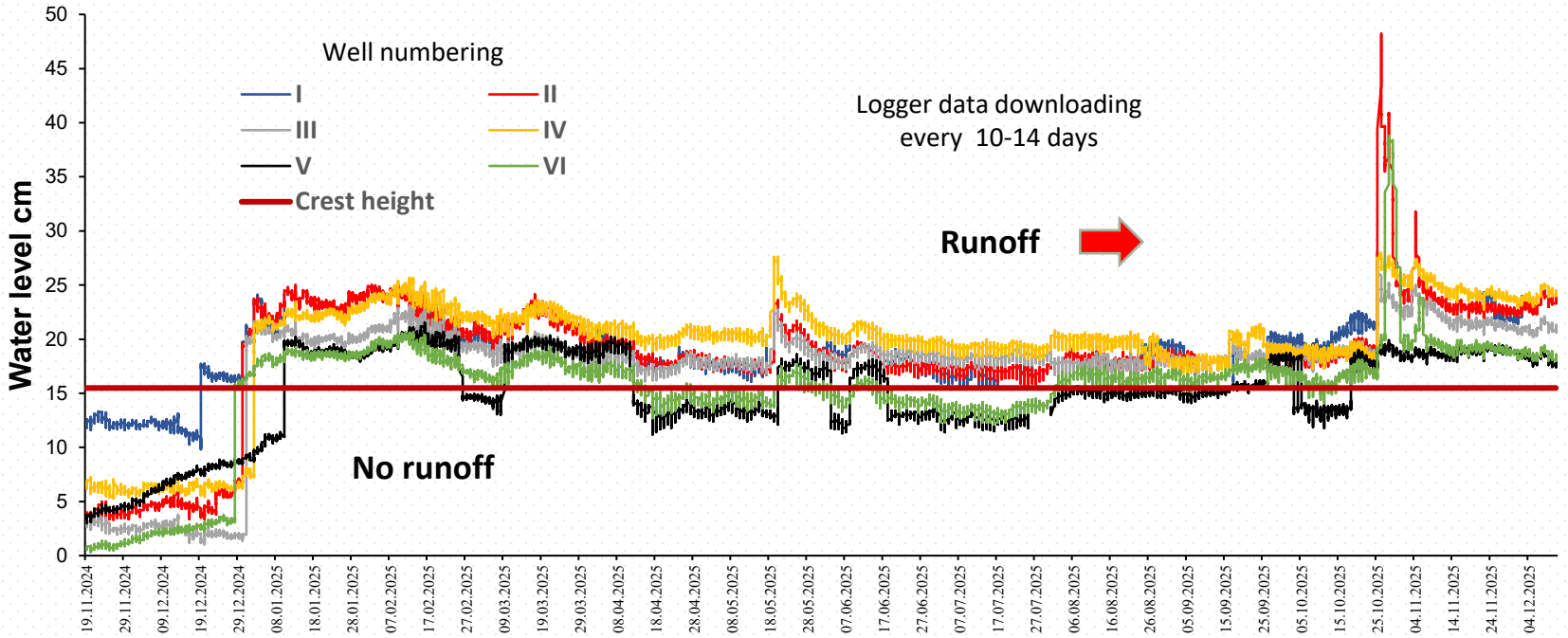
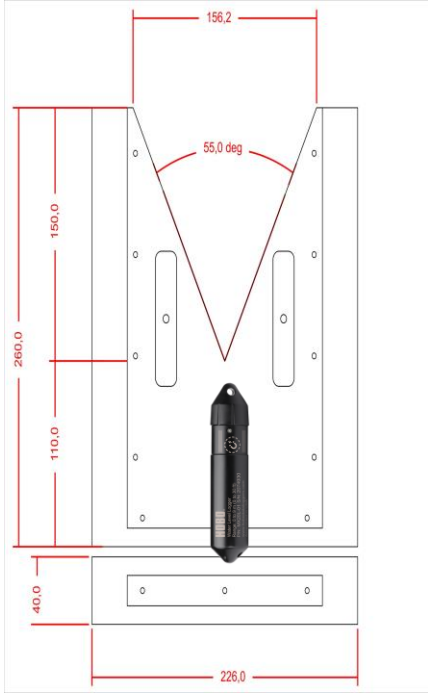
Meteo & hydrological variables
(hourly records)







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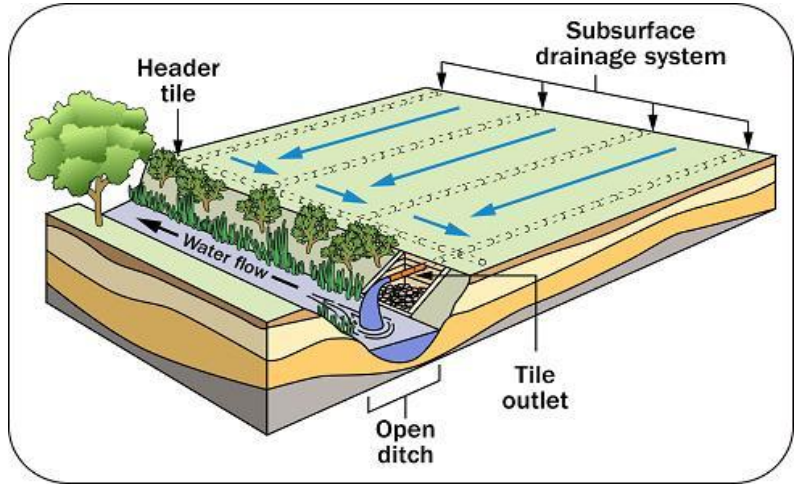
Composite Sampling Approach in WQ Monitoring

Composite sampling involves **combining multiple individual water** samples collected at different times into one mixed sample for laboratory analysis!



Benefits:

- Represents average conditions over a defined period;
- More representative (captures **variability!**);
- Reduces random error;
- Cost-effective;
- Especially useful when combined with continuously measured runoff (**substance loads**!)

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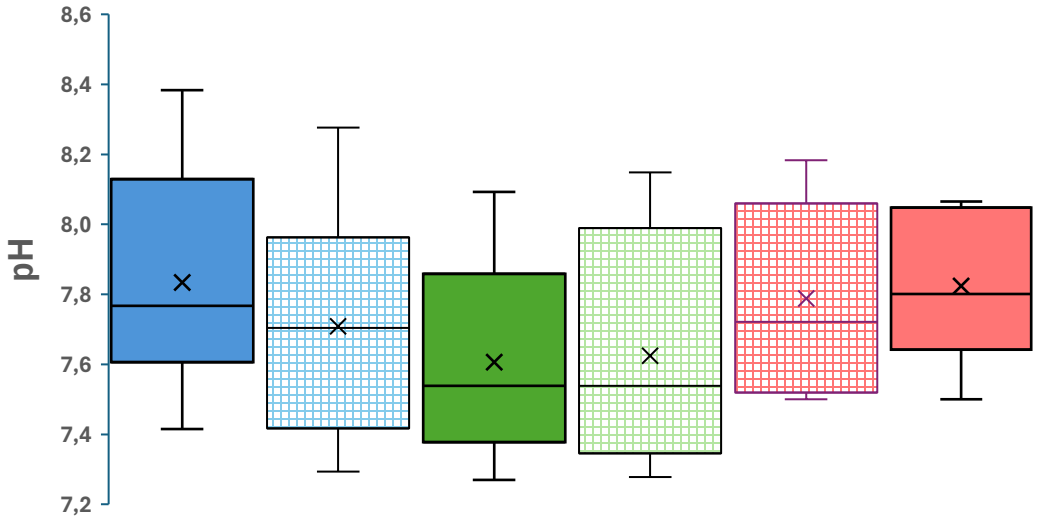
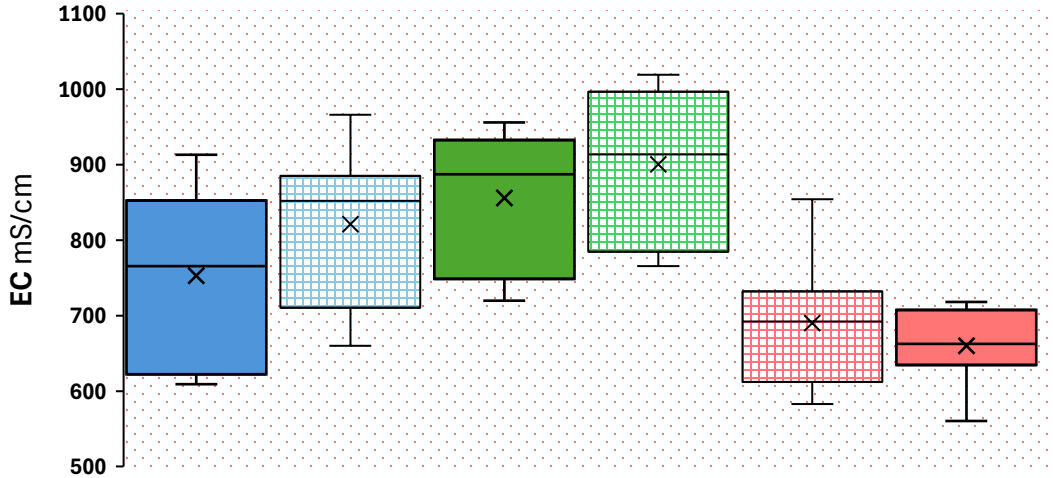
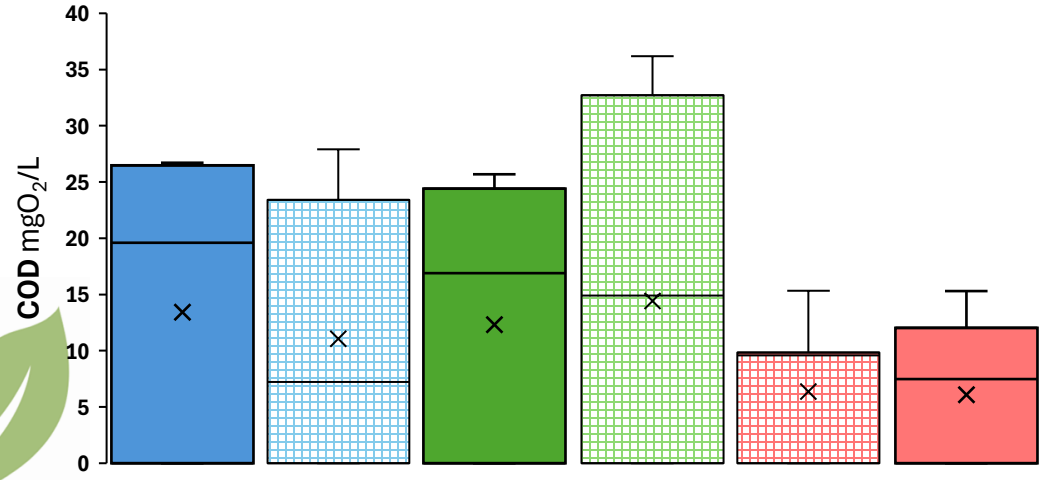
Water chemistry in Drainage outflow (KPIs)







Fields in demo sites I, II and III:

Legend:

- 1-compost applied
- 1-without compost
- 2-compost applied
- 2-without compost
- 3-without compost
- 3-compost applied

Abbreviations:

COD – Chemical oxygen demand;
EC – Electrical conductivity

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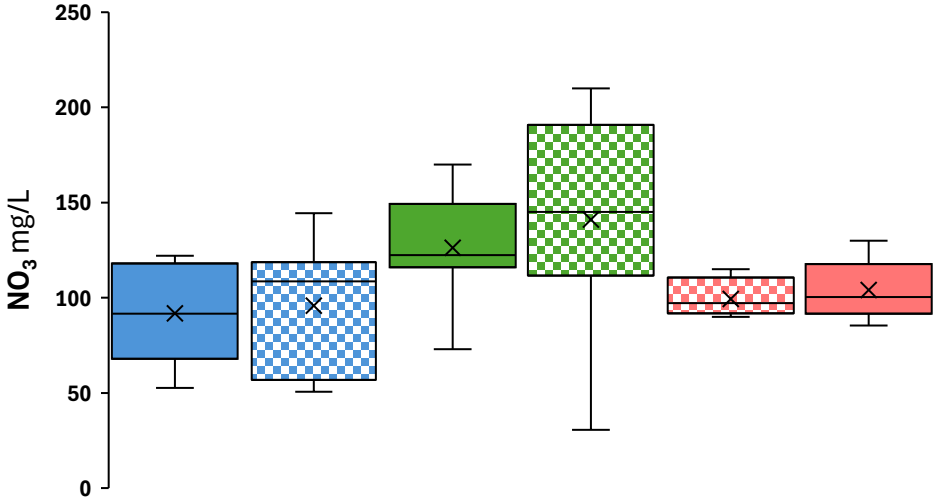
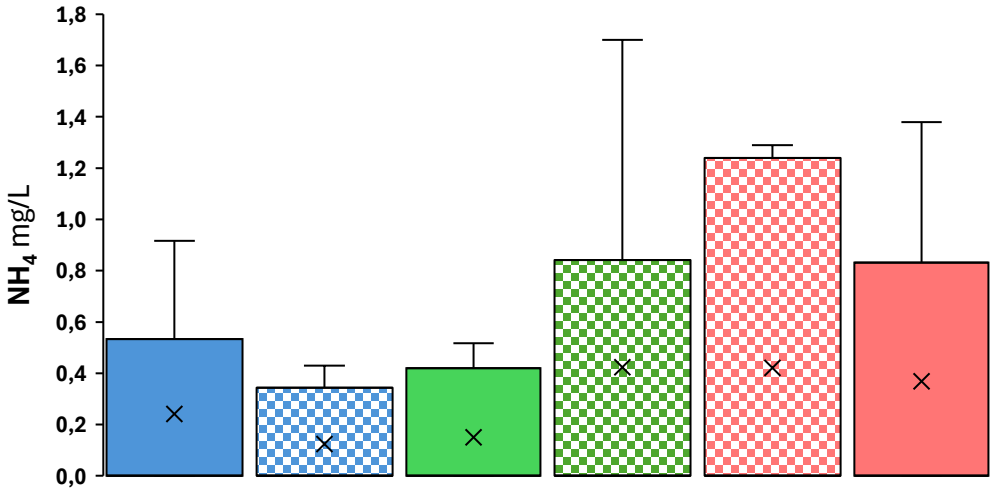
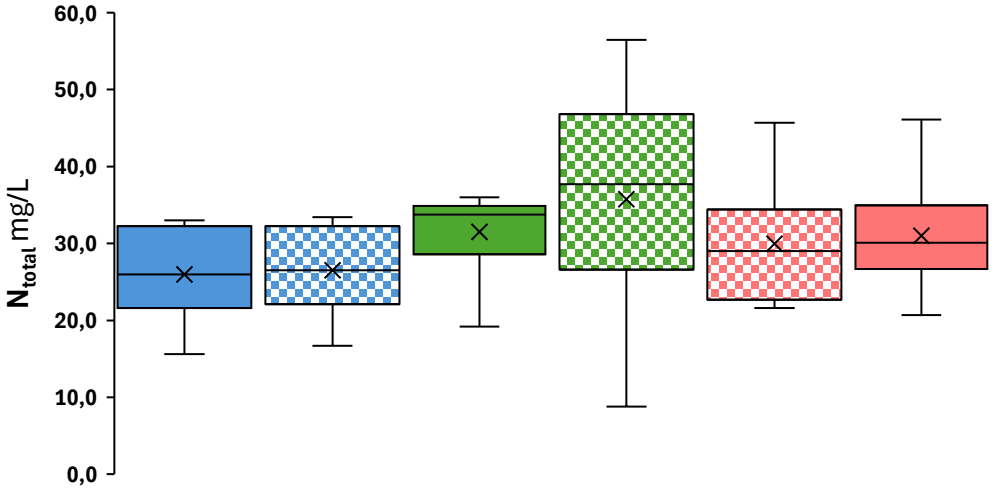
Nitrogen (N) compounds in Drainage outflow







Fields in demo sites I, II and III:

- 1-compost applied
- 1-without compost
- 2-compost applied
- 2-without compost
- 3-without compost
- 3-compost applied

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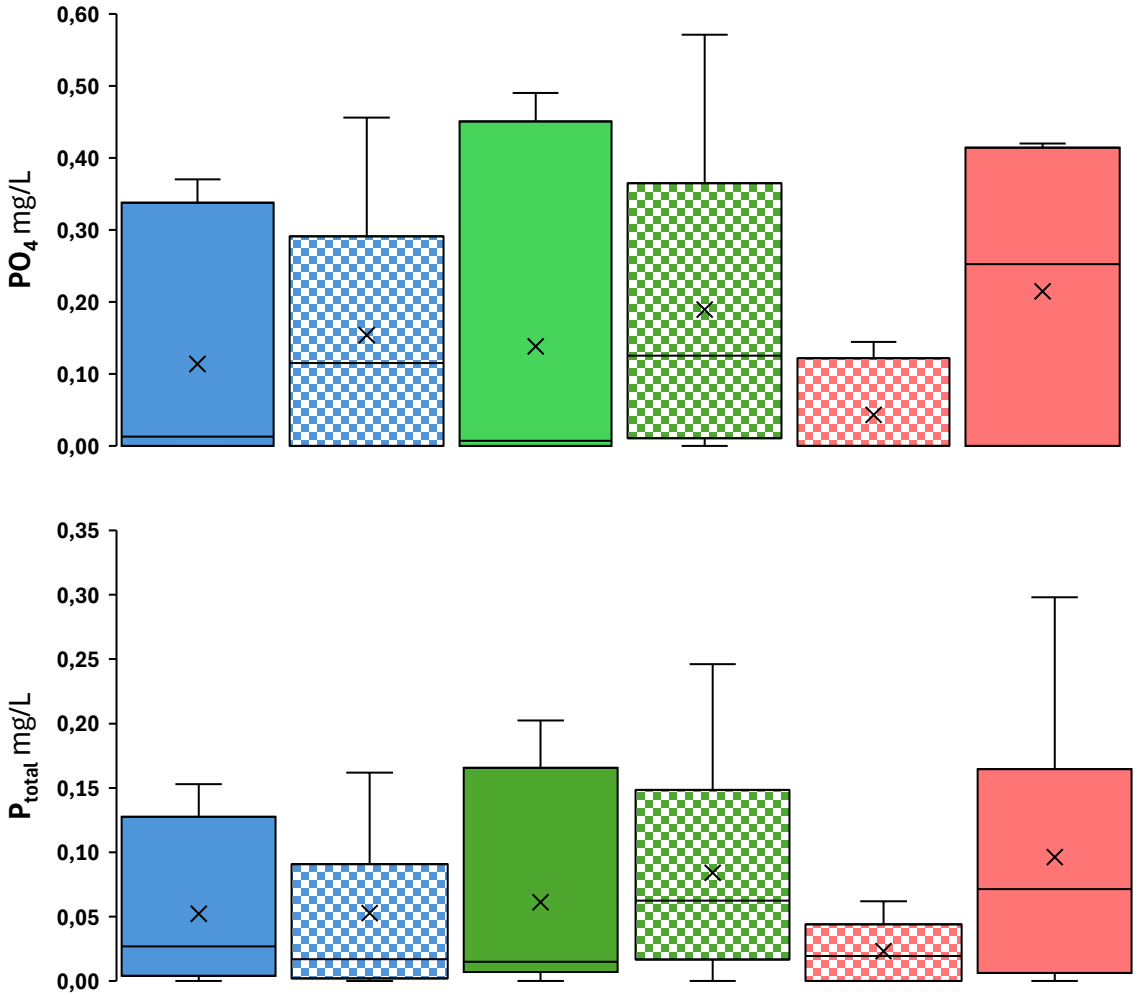
Phosphorus (P) compounds in Drainage outflow



Fields in demo sites I, II and III:

Legend:

- 1-compost applied
- 1-without compost
- 2-compost applied
- 2-without compost
- 3-without compost
- 3-compost applied

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Chemical parameters in harvested yield

Yield, t/ha	Demosite I	In harvested:	Indicators on a dry matter														
			Proteins %	N %	P %	K %	Ca %	Mg %	Na %	Fe mg/kg	Zn mg/kg	Cu mg/kg	Mn mg/kg	Pb mg/kg	Cd mg/kg	Starch %	Corg. %
8,1	Compost applied	Wheat	12,39	2,17	0,385	0,476	0,277	0,156	0,285	96,6	31,65	11,12	27,67	<0,25mg/kg	<0,05mg/kg	69,8	46,4
		Straw		0,714	0,106	0,796	0,484	0,105		180,1	9,32	6,88	25,50	<0,25mg/l	<0,05mg/kg		46,7
	Without compost	Wheat	12,06	2,12	0,335	0,446	0,319	0,154	0,306	120,2	34,14	10,37	29,59	<0,25mg/kg	<0,05mg/kg	70,1	46,3
		Straw		0,670	0,082	0,755	0,528	0,103		187,9	<0,1mg/kg	6,48	23,32	<0,25mg/kg	<0,05mg/kg		47,15
	Demosite II																
4,7	Compost applied	Beans	30,63	4,90	0,754	3,55	0,304	0,177	0,021	67,4	<0,1	14,27	22,19	1,23	<0,05	44,1	46,19
		Stems	13,69	2,19	0,274	3,20	1,541	0,254	0,023	247,2	<0,1	8,02	25,44	3,71	<0,05	3,6	43,69
4,3	Without compost	Beans	30,44	4,87	0,707	2,12	0,308	0,171	0,022	76,3	<0,1	18,15	20,91	0,83	<0,05	44,5	45,83
		Stems	10,94	1,75	0,141	1,48	1,012	0,274	0,077	167,4	<0,1	11,86	20,25	2,36	<0,05	3,8	46,11
	Demosite III																
4,5	Compost applied	Wheat	14,32	2,51	0,422	0,524	0,335	0,169	0,339	134,5	31,80	8,90	42,84	<0,25mg/kg	<0,05mg/kg	62,8	46,8
		Straw		0,679	0,127	0,755	0,459	0,115		138,3	7,19	5,79	37,56	<0,25mg/kg	<0,05mg/kg		46,63
	Without compost	Wheat	12,20	2,14	0,367	0,463	0,194	0,133	0,281	137,9	23,64	11,74	48,08	<0,25mg/kg	<0,05mg/kg	68,5	46,9
		Straw		0,461	0,081	0,662	0,411	0,132		155,1	7,37	3,25	31,30	<0,25mg/kg	<0,05mg/kg		46,81

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Summary of Observed One-Year Effects of Composted Sludge Application (KPIs-based)

No clear effect on total N losses through drainage water (although there was a tendency to reduce NH_4 losses), but a likely increase in P losses.

Other agricultural factors, particularly mineral fertilizer application and crop type, may contribute to masking the effect of composted sludge.

Question! **Should effects be expected after one year?**

- The effects of composted sludge are generally gradual and cumulative!
- The **impacts are more likely** to become evident **over the longer term**!

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The work is moving forward to the 2026 activities !

Thank You!

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