EGU General Assembly 2022

IMSOGLO International Master of Science in Soils and Global Change

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GHENT UNIVERSITY

Joint FAO/IAEA Division of Nuclear Techniques in Food and Agriculture

With the support of the Erasmus+ Programme of the European Union

Greenhouse gas emissions from worm-compost-biochar combinations from farm to production to fork

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Thursday, 26th May 2022

Vienna, Austria

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Abstract & display material

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Background & Objectives

- Worm-composting : vermicast
- Soil amendment with positive effects on soil physico-chemical properties promoting productivity (Pramanik, 2010)
- Circular economy and green business

- Worms are responsible for emissions of potent GHG (N_2O)
- The addition of Biochar (BC) to the system to reduce the N_2O emissions (Wu et al, 2019)

- Our central hypothesis is that BC will reduce N_2O emissions from the worm treatments and that,

- Greater reductions in worm emissions when BC is added after (Compost-BC-worms) the initial hot composting process than when added before (BC-compost-worms).

Experiment setup

- Greenhouse exp at IAEA (Seibersdorf Laboratories)
- Experimental setup (pot)
- Labelling ^{15}N

EXPERIMENTAL DESIGN

		TABLE I					TABLE II			
	Lines	1	2	3	4		5	6	7	8
BLOCK I	1	Comp 2-1	Comp W-1-3	No Plant 7-1	BC-Comp 3-3		BC-Comp 3-1	Comp 2-3	Soil only 6-1	Comp 2-2
	2	BC-Comp 3-2	15N Inorg 5-2	Comp BC 4-1	Soil only 6-2		Comp BC 4-2	Comp W-1-2	15 Inorg 5-3	No Plant 7-2
	3	Comp W-1-1	Soil only 6-3	15N Inorg 5-1			No Plant 7-3	Comp BC 4-3		
BLOCK II	1	Comp W-1-4	BC-Comp 3-6	Soil only 6-5	Comp BC 4-6		15N Inorg 5-6	Comp 2-4	Comp BC 4-4	BC-Comp 3-5
	2	Comp 2-5	No Plant 7-5	Comp 2-6	15N Inorg 5-5		Comp BC 4-5	No Plant 7-6	Comp W-1-5	No Plant 7-4
	3	BC-Comp 3-4	Soil only 6-6	Comp W-1-6			15N Inorg 5-4	Soil only 6-6		
BLOCK III	1	BC-Comp 3-7	15N Inorg 5-9	Comp BC 4-8	BC-Comp 3-8		BC-Comp 3-9	Comp 2-8	Comp BC 4-7	15N Inorg 5-8
	2	15N Inorg 5-7	Soil only 6-9	No Plant 7-8	Soil only 6-8		Comp W-1-8	Soil only 6-7	Comp 2-7	No Plant 7-7
	3	Comp 2-9	Comp W-1-7	Comp BC 4-9			No Plant 7-9	Comp W-1-9		

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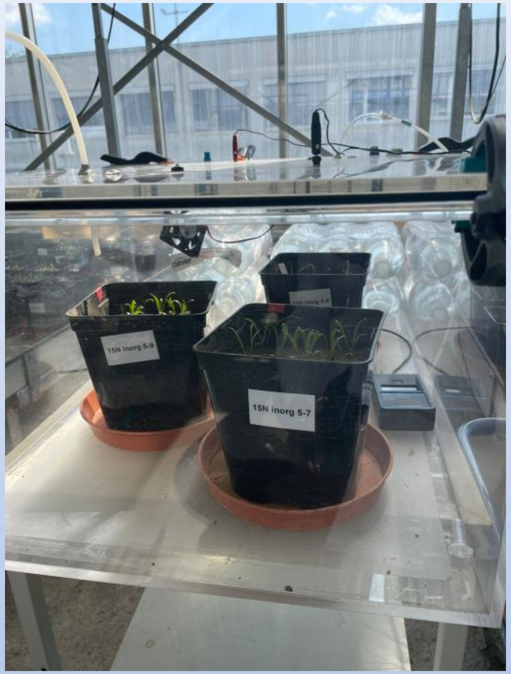
Materials & Methods

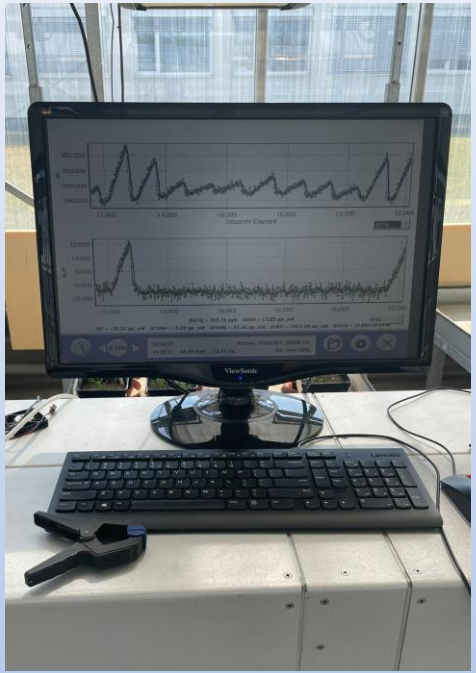
- GHG exchange:
  N2O & corresponding isotopes ($\delta^{15}N$)
  Manual Chamber + Trace Gas Analyser (LGR)
- Soil Moisture (water use)

BOKU Tulln Labs (Stable Isotope Group)

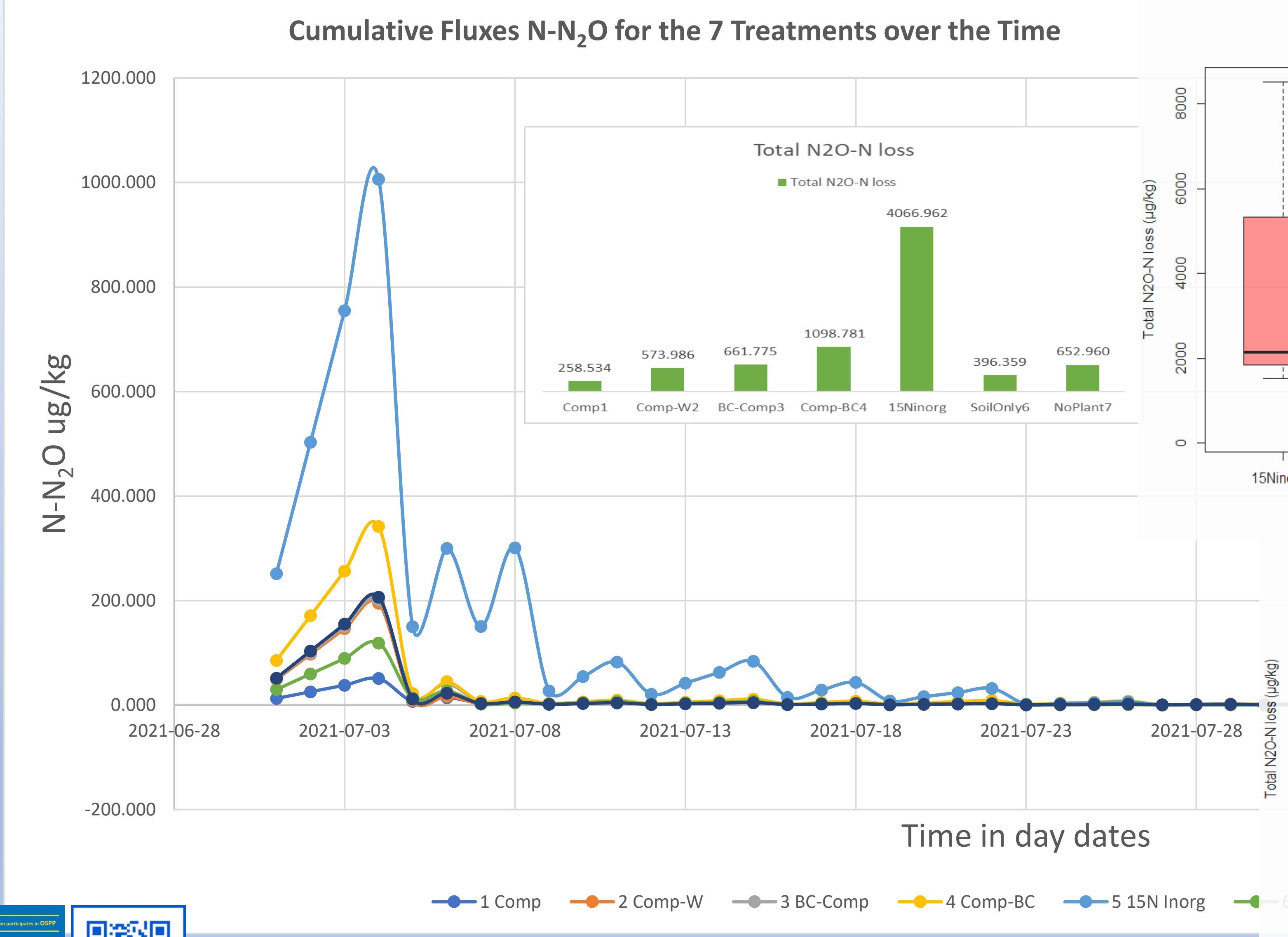
- Aboveground biomass
- Soil Sampling
- Inorganic N (NH_4-N &NO_3-N) – 0.5M K2SO4
- Microbial Biomass (CFEM)
- EA-IRMS measurements (N content & $\delta^{15}N$)

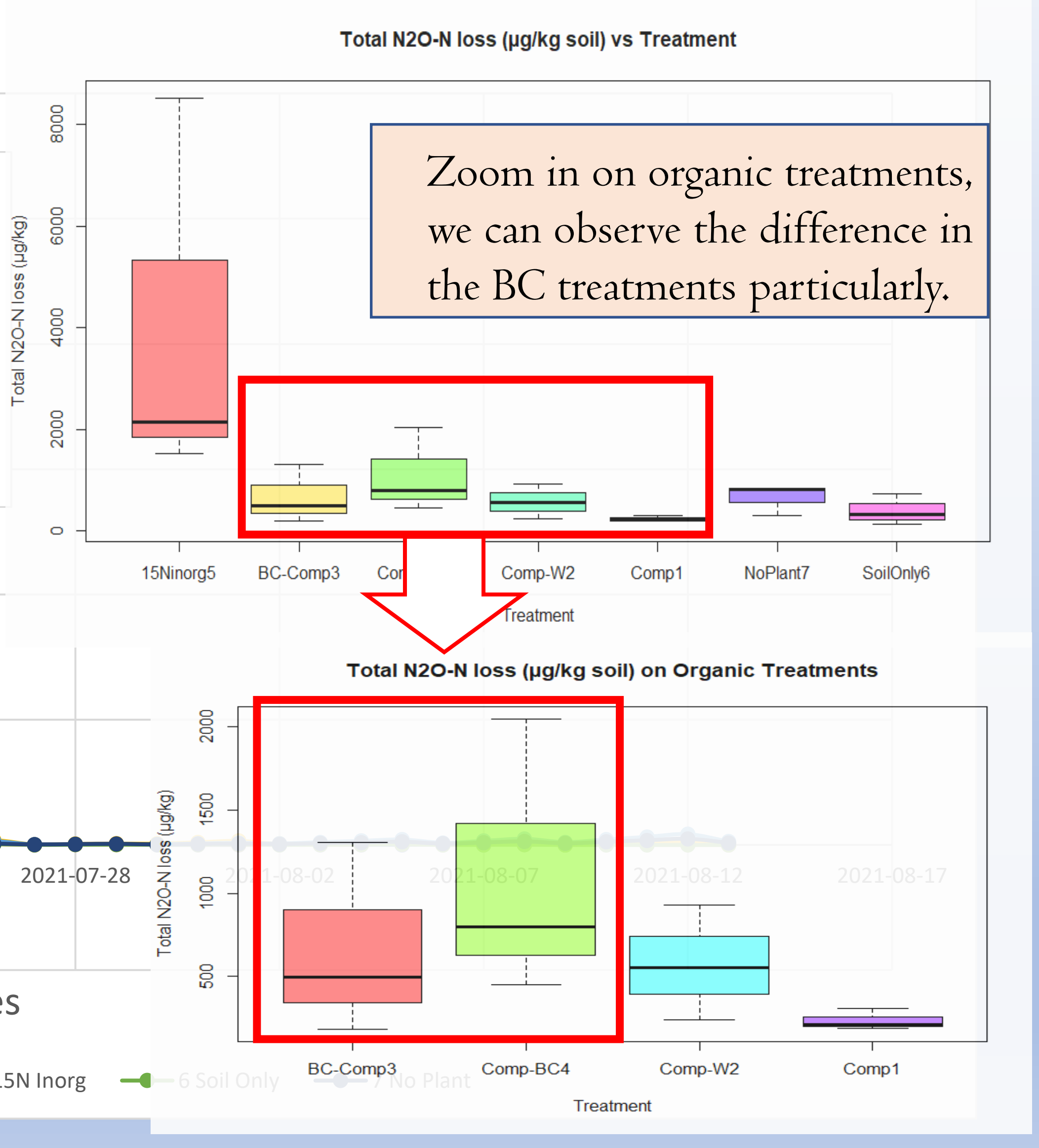
- Statistics & Data Analysis with RStudio & Excel





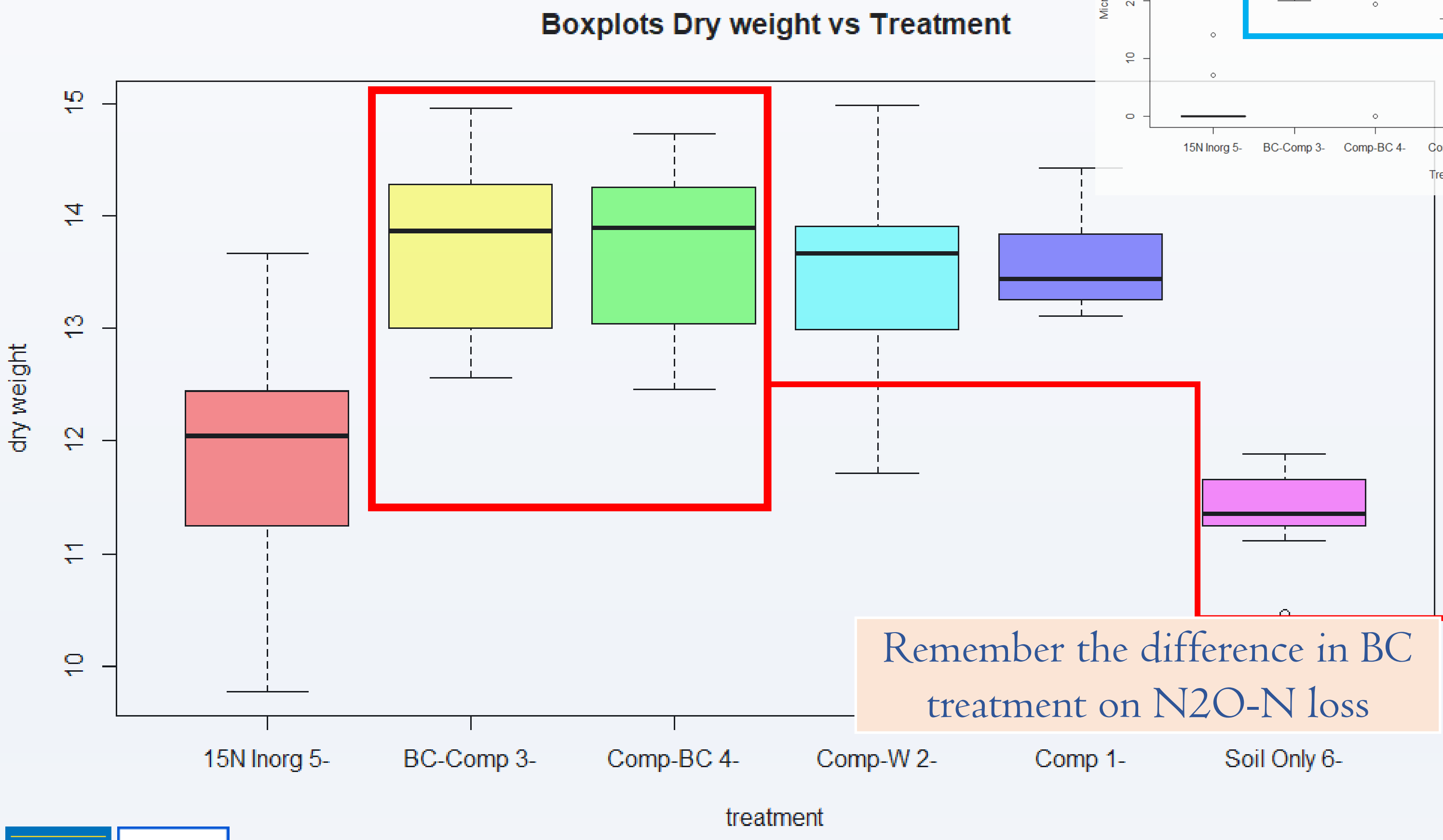
Results

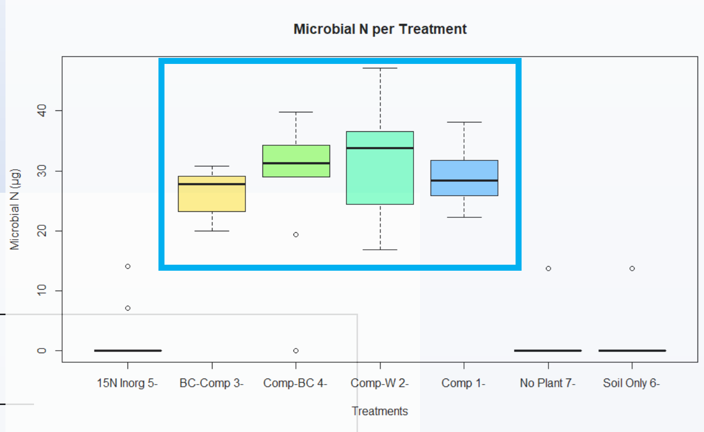


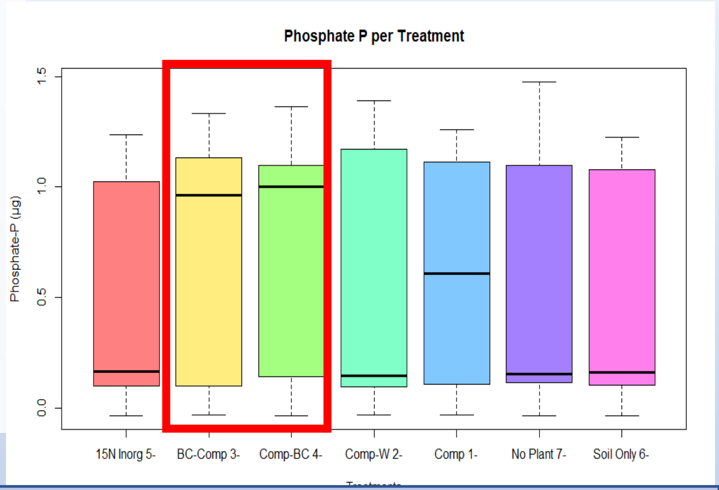


Zoom in on organic treatments, we can observe the difference in the BC treatments particularly.

Results

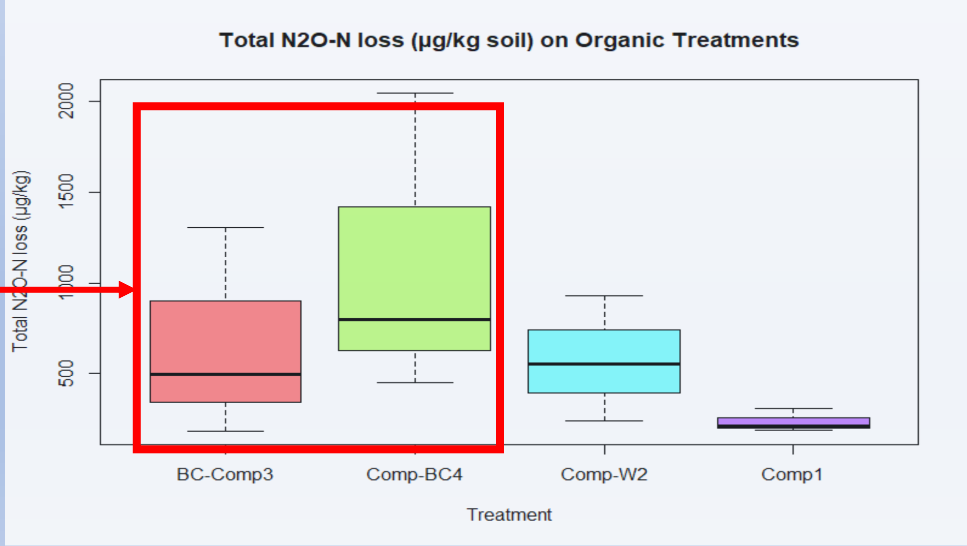






Can P be seen as a limiting factors to inorganic treatments?

Remember the difference in BC treatment on N2O-N loss



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Summary & take home message

- Although many have suggested increased N_2O emissions from Compost and Worm-Compost we couldn't observe much emissions
- Overall organic treatments showed far less N_2O emissions compared conventional production (inorganic fertilization) and plant production was enhanced in compost treatment.
- BC didn't reduce emissions, BC-Comp showed slightly higher N_2O emissions compared to Comp and Comp-W, but offers the best trade-off between soil improvement and plant production overall
- The results seen from this work add to knowledge base for advocacy of the use of worm-compost-biochar as valuable peat alternative and open a path for further research
- Decision making on peri-urban food wastes management – circular economy and sustainability strategies. Farm to Fork strategy - for a fair, healthy and environmentally-friendly food system (EU Green Deal 2020)

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Thank you for your attention !

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