BIOCHARS FROM DIFFERENT RESIDUES HAVE A DISTINCT IMPACT ON SOIL N DYNAMICS

I. López-Cano, M. L. Cayuela* , A. Roig, M. A. Sánchez-Monedero

CEBAS-CSIC. Campus Universitario de Espinardo. 30100. Espinardo. Murcia. Spain

*Presenting author: *mlcayuela@cebas.csic.es*

Introduction

The use of biochar, a carbonaceous material obtained by pyrolysis of biomass, is known to interact with key processes involved in soil N cycling: mineralization, denitrification, nitrous oxide emissions and N fixation.

Aim

To study the impact of biochars from different lignocellulosic residues upon the N mineralization dynamics and N availability in an agricultural soil amended with either sheep manure or mineral fertilisation.

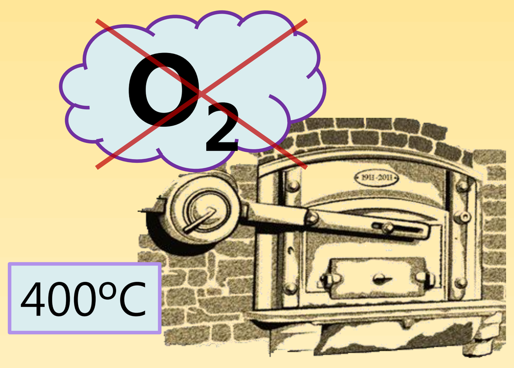
Material and methods

Soil description

	Soil
Sand (%)	52
Silt (%)	21
Clay (%)	27
pH	8.1
EC (dS m-¹)	0.51
TOC (%)	1.7
TN (%)	0.3

Feedstock and biochar description

	Raw materials	OAK	GHW	PRE	CEL
Lignocellulosic component	Lignin (%)	31.3	24.9	13.0	24.4
	Cellulose (%)	52.8	56.9	22.8	55.8
	Hemicellulose (%)	14.7	6.5	<0.5	0.6



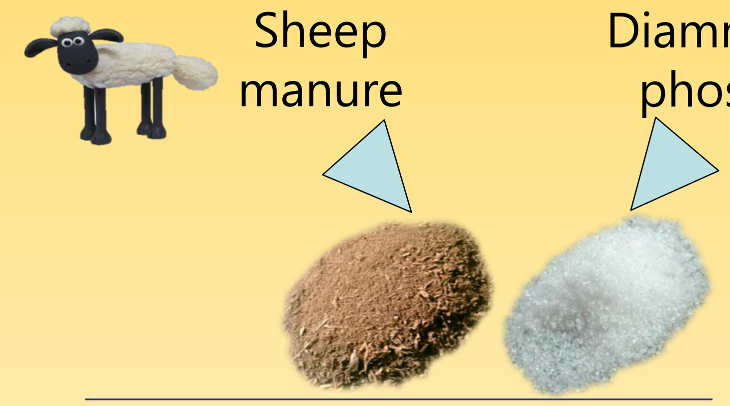
	Biochars	OAK	GHW	PRE	CEL
Proximate analysis	Ash (%)	8.4	16.7	76.7	50.0
	VM (%)	24.4	25.0	11.7	26.4
	Fixed C (%)	67.2	58.3	11.6	23.6
	pH	9.6	9.5	10.2	9.4
	EC (dS m-¹)	0.58	1.27	1.14	2.25
Ultimate analysis	TC (%)	71.53	63.95	17.55	37.37
	TN (%)	0.3	1.1	0.9	1.3
	P (g/kg)	0.07	0.23	0.55	0.42
	K (g/kg)	0.90	3.29	1.07	0.82

VM: Volatile matter; EC: Electrical conductivity; TC: Total carbon; TN: Total nitrogen;

Amendment/fertiliser description

Organic amendment Sheep manure

Mineral fertiliser Diammonium phosphate



	Manure	DAP
Ash (%)	54.4	
pH	9.05	
EC (dS m-¹)	3.89	
TC (%)	19.6	
TN (%)	2.0	20.8
P (%)	1.5	23.0

EC: Electrical conductivity; TC: Total carbon; TN: Total nitrogen; P: phosphate

Treatments

Soil

With/without soil amendments
- Manure (1% w/w)
- Fertiliser (same amount to N provided by manure, 198 mg N kg^{-1} soil)

With/without biochar
- 4 biochars (1% w/w)

x1 Soil treatment
x3 Amendment treatments
x5 Biochar treatments
x3 Replicates

Incubation experiments

100 mL glass container

T= 25 ºC; WHC: 40%; 40 gr sample (w/w)

Preincubation t= 7 days → Aerobic incubation t= 30 days; Ammonium and nitrate analysis(t=3 and 30 days)

Results and Discussion

Biochar-soil interaction

- t= 3 days: No differences on soil ammonium and nitrate content.
- t= 30 days: The levels of soil NH_4^+-N were not affected by the addition of biochar.

  The addition of biochar prepared from rich lignocellulosic feedstock (OAK and GHW) did not alter soil N dynamics after 30 days of incubation.

  High ash content biochars (PRE or CEL) significantly increased soil available N.

Biochar- amended soil interaction

- t= 3 days: N dynamics at the beginning of the incubation were different for each biochar. OAK or CEL biochar originated a reduction of NH_4^+-N concentration in the amended soils.
- t= 30 days: At the end of incubation all treatments showed similar NO_3^--N levels.

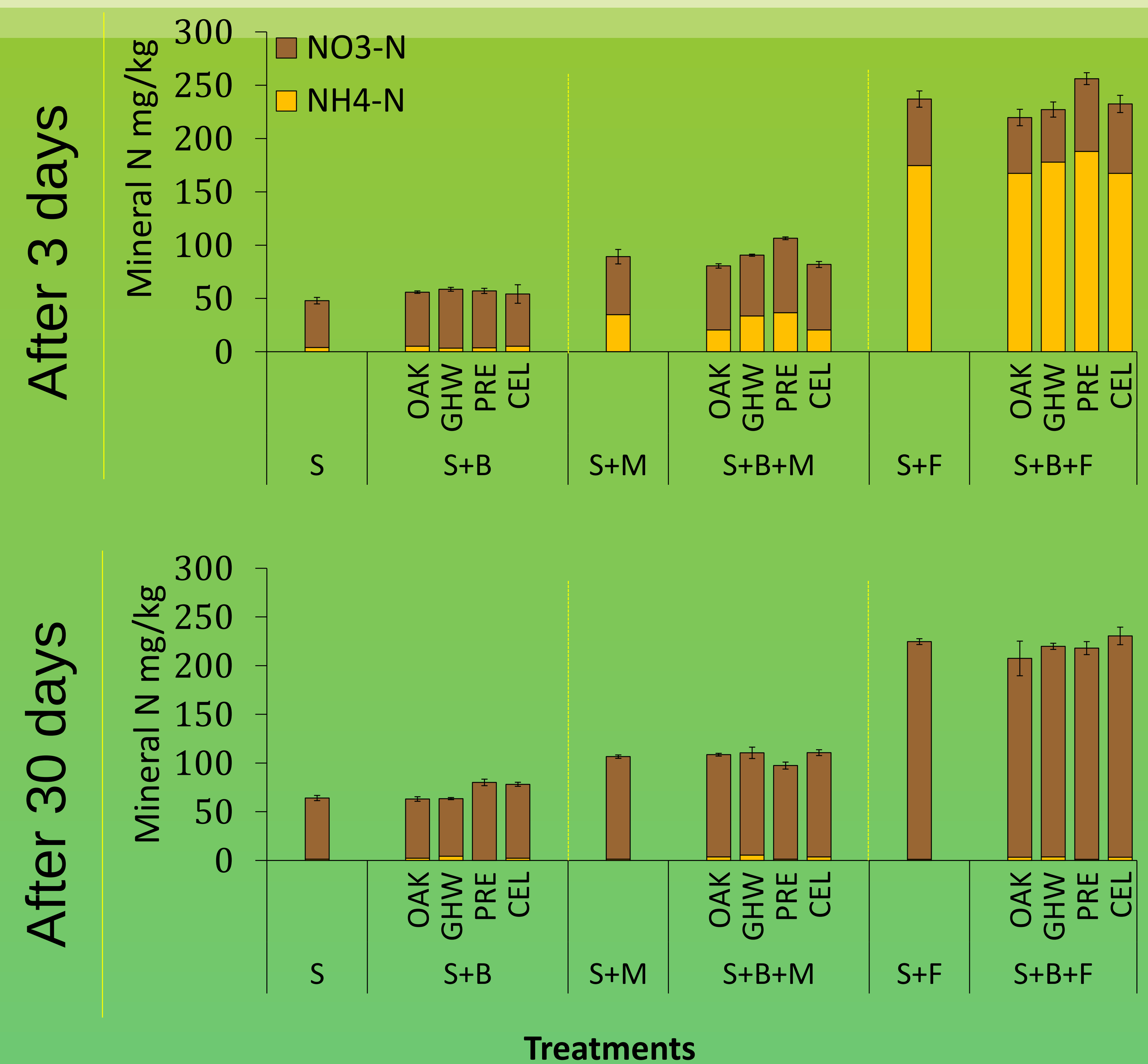


Fig. 1. Mineral N (NH_4^+-N and NO_3^--N) in the soils amended with the different treatments after 3 and 30 days of incubation.

Conclusions

The different lignocellulosic composition of the feedstock used for the preparation of the biochar affected the initial N dynamics in the agricultural soil amended with either an organic amendment or mineral fertiliser. However, the levels of NO_3^--N were similar or slightly lower than the control after 30 days of incubation.

These observations suggest a reduction of soil mineral N in biochar soils, which can reduce the risk of NO_3^--N lixiviation.

Acknowledgments

This work was supported by the EU project FP7 KBBE.2011.1.2-02 FERTIPLUS "Reducing mineral fertilisers and agro-chemicals by recycling treated organic waste as compost and bio-char" project nr. 289853 co-funded by the European Commission, Directorate General for Research & Innovation, within the 7th Framework Program of RTD, Theme 2 -Biotechnologies, Agriculture & Food.