

# Multi-season effects of biochar and N on N<sub>2</sub>O-N fluxes in a Ferralsol

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## Introduction

Biochar is the charred by-product of biomass pyrolysis (Sohi et al. 2010). A wood biochar is generally alkaline and rich in micro pores, characteristics that in theory would contribute to increase absorption of ammonium and soil water, lowering nitrous oxide (N<sub>2</sub>O-N) (Clough and Condon 2010). Yet, detailed and consistent information about soil born N<sub>2</sub>O-N fluxes with biochar amendment under real farming conditions are lacking.

## Material and Methods

We used manual, static chambers to quantify N<sub>2</sub>O-N fluxes arising from a Ferralsol throughout four cropping seasons after a single application of wood biochar (32 Mg ha<sup>-1</sup>, incorporated to a depth of 0-15 cm) followed by annual N applications (90 kg N ha<sup>-1</sup>). Soil ammonium (N-NH<sub>4</sub><sup>+</sup>) and nitrate (N-NO<sub>3</sub><sup>-</sup>) availability and water filled pore space (WFPS) were measured alongside N<sub>2</sub>O-N fluxes.

## Results and Conclusions

A single application of 32 Mg ha<sup>-1</sup> biochar amendment does not mitigate N<sub>2</sub>O-N fluxes from the N fertilizer applied. The mineral N application enhances N<sub>2</sub>O-N fluxes, soil N-NH<sub>4</sub><sup>+</sup> and N-NO<sub>3</sub><sup>-</sup> availability, especially in seasons characterized by lower WFPS.

Table 1. Nominal significance level (p values) arising from F tests for the effects of mineral N fertilization (N) and biochar (CHAR), and their interaction (N \* CHAR), on N<sub>2</sub>O-N fluxes and soil related variables along four cropping seasons on a clay Ferralsol.

Effects	N <sub>2</sub> O-N	N-NH <sub>4</sub> <sup>+</sup>	N-NO <sub>3</sub>	WFPS	N <sub>2</sub> O-N	N-NH <sub>4</sub> <sup>+</sup>	N-NO <sub>3</sub>	WFPS
	-----S0.0-----				-----S0.5-----			
N	0.4605	0.2075	<b>0.0081(↑)</b>	0.9362	<b>0.0408(↑)</b>	<b>&lt;.0001(↑)</b>	<b>0.0001(↑)</b>	0.2685
CHAR	0.7876	0.8772	0.4548	0.5487	0.4012	0.7191	0.8314	0.4633
N*CHAR	0.1159	0.6985	0.5054	0.3153	0.3256	0.8515	0.5461	0.9359
	-----S1.5-----				-----S2.5-----			
N	0.0791	<b>&lt;.0001(↑)</b>	<b>&lt;.0001(↑)</b>	<b>&lt;.0001(↓)</b>	<b>0.0024(↑)</b>	<b>&lt;.0001(↑)</b>	<b>&lt;.0001(↑)</b>	<b>&lt;.0001(↓)</b>
CHAR	0.0804	0.1898	0.6637	<b>&lt;.0001(↓)</b>	0.9767	0.1898	0.6637	<b>&lt;.0001(↓)</b>
N*CHAR	0.5707	0.5212	0.6818	0.5093	0.3098	0.5212	0.6818	0.5093
N <sub>2</sub> O-N: nitrous oxide fluxes (µg m <sup>-2</sup> per hour); N-NO <sub>3</sub> <sup>-</sup> : available soil nitrate (mg kg <sup>-1</sup> ); N-NH <sub>4</sub> <sup>+</sup> : available soil ammonium (mg kg <sup>-1</sup> ); and WFPS: soil water filled pore space (%). Seasons: immediately (S0.0) and at 0.5 (S0.5), 1.5 (S1.5) and 2.5 (S2.5) years after biochar application. (↑): increases; (↓) decreases.								

## References

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Acknowledgements

Funds provided by Embrapa, CNPq and CCAFS/CLIFF Network.