

Effect of biochar on soil greenhouse gas emissions at the laboratory and field scales:

Supplementary Information

Rivka B. Fidel¹, David A. Laird², and Timothy B. Parkin³

*¹Department of Soil, Water and Environmental Science, The University of Arizona, Tucson, AZ,
85721*

²Department of Agronomy, Iowa State University, Ames, IA 50011, USA

³USDA-ARS, 1015 N University Blvd, Ames, IA 50011, USA

Correspondence: Rivka B. Fidel, tel. +1 520 626 6681, email rfidel@email.arizona.edu

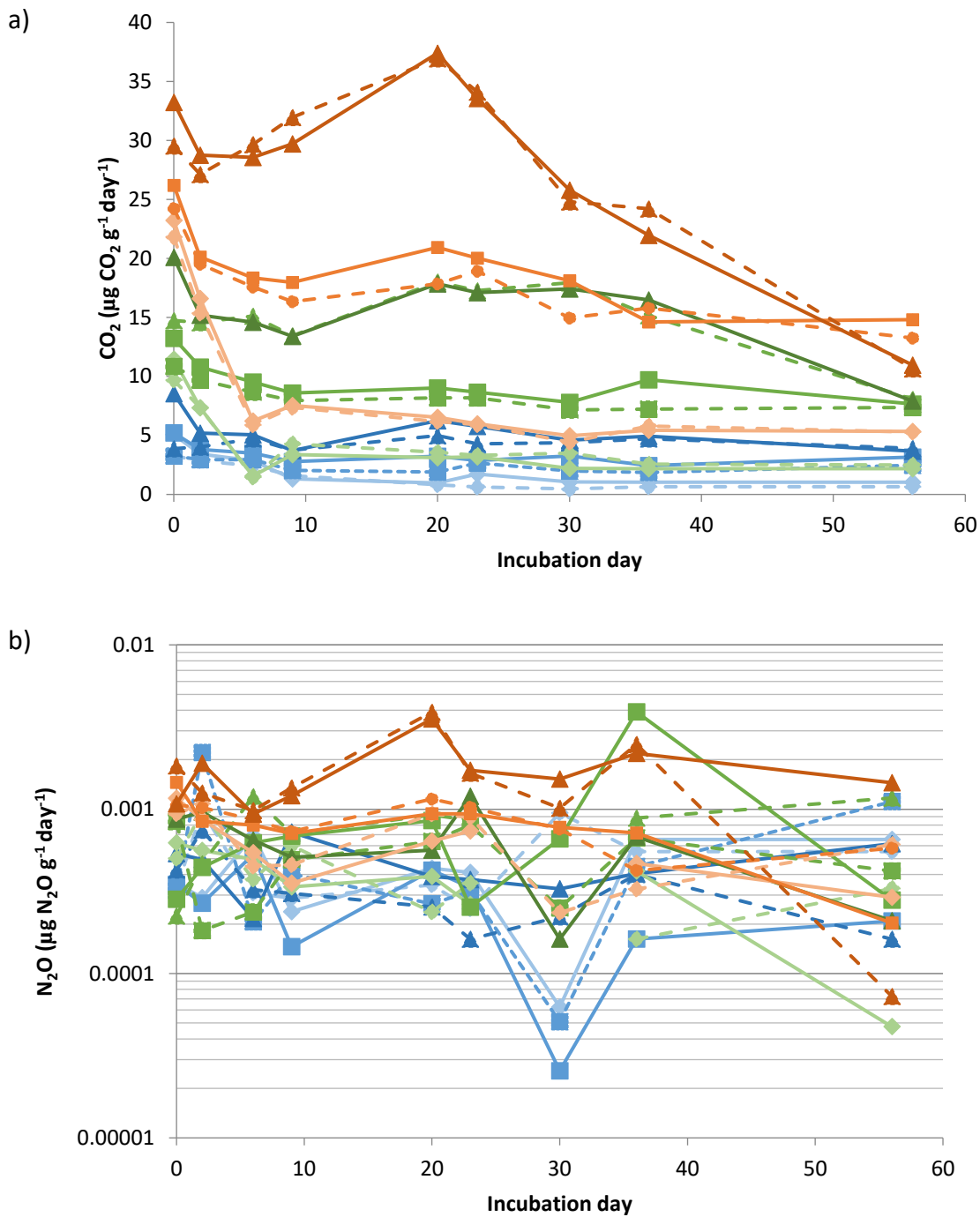


Figure S1. Daily soil (a) CO₂ and (b) N₂O emissions measured during the equilibration period of the laboratory incubation study (pre-fertilization). (blue = 10°C, green = 20°C, orange = 30°C; diamonds = 27%, squares = 31%, and triangles = 35% moisture; dashes = controls, solid lines = biochar)

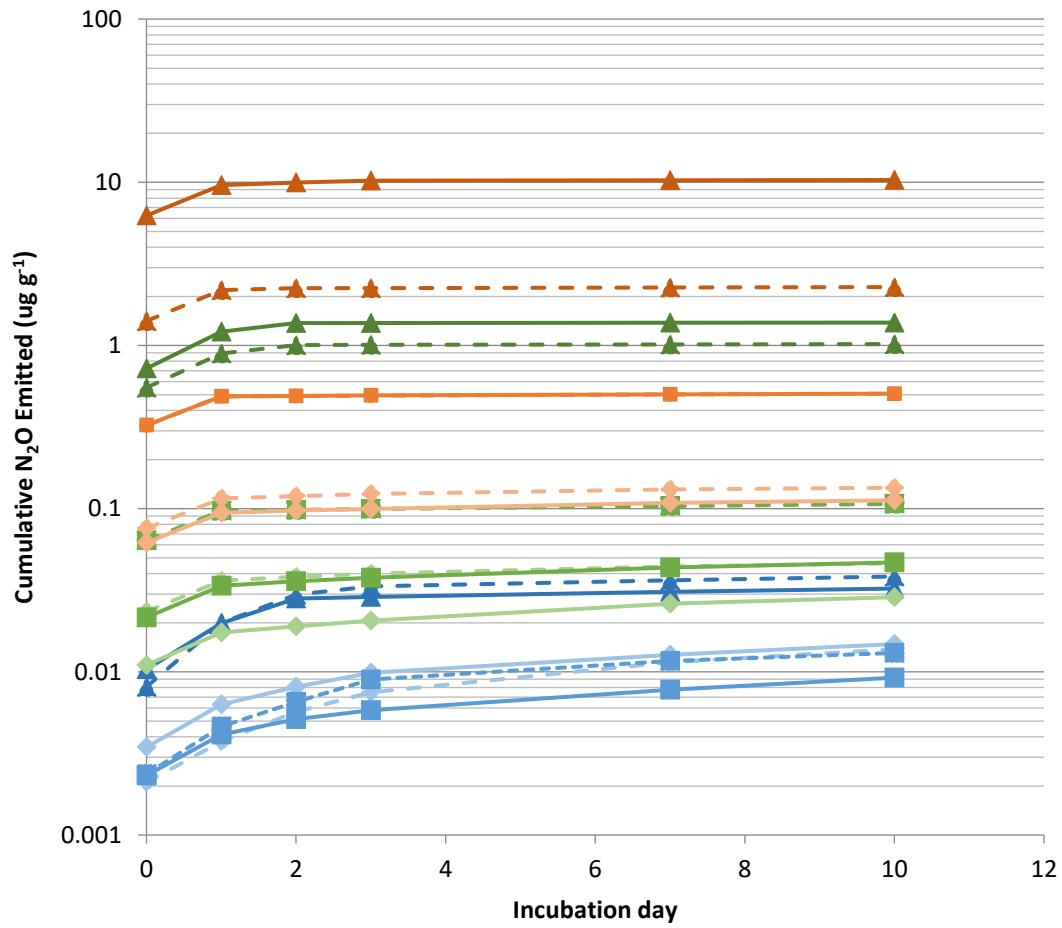


Figure S2. Cumulative N₂O emissions measured post-fertilization during the incubation study. (blue = 10°C, green = 20°C, orange = 30°C; diamonds = 27%, squares = 31%, and triangles = 35% moisture; dashes = controls, solid lines = biochar)

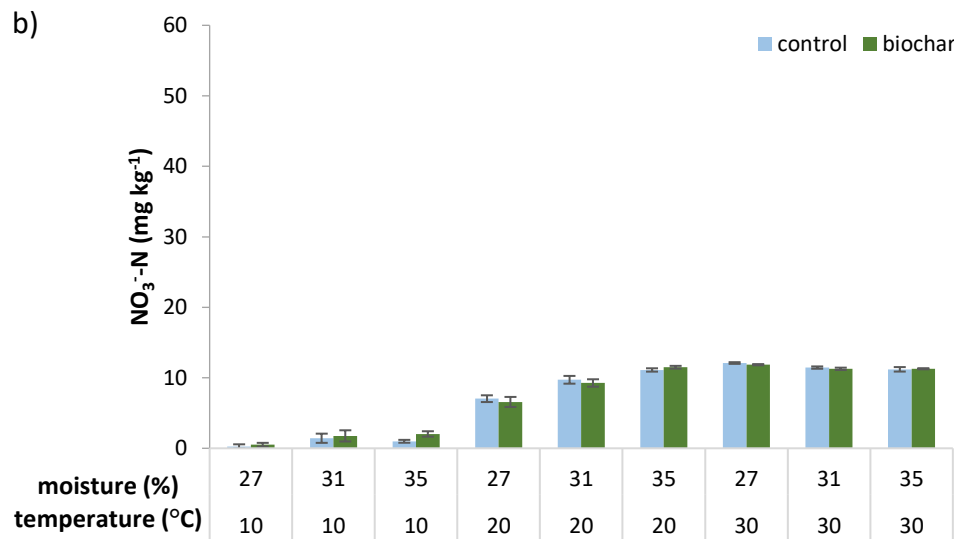
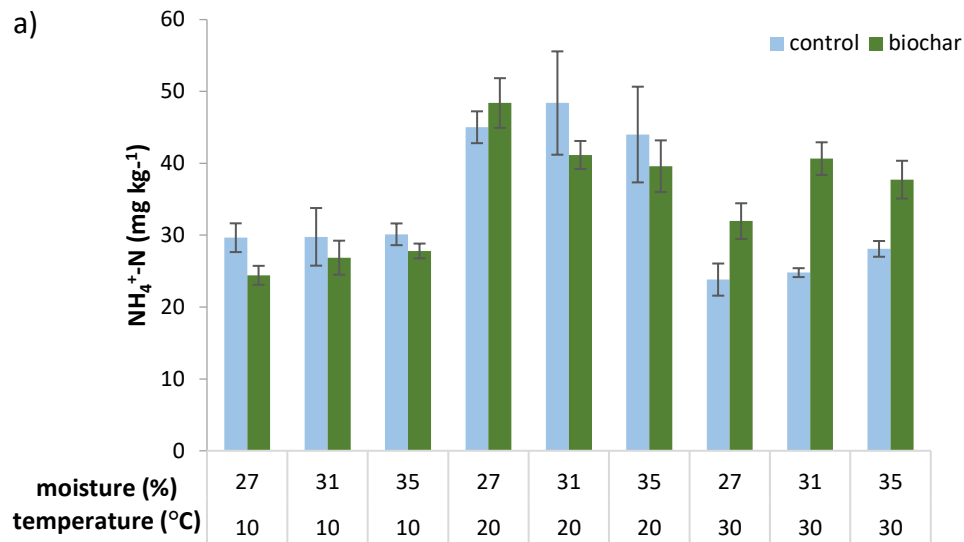


Figure S3. Final (a) NH_4^+ and (b) NO_3^- concentrations, in mg of N per kg soil, after 140 day incubation at three temperatures and moistures, with and without biochar.

Table S1 Repeated measures statistical results from analysis of daily post-fertilization soil incubation emissions data, presented as p-values (significance evaluated at $p < 0.05$).

Effect	N₂O	CO₂
<i>biochar</i>	0.2996	0.0382
<i>temp</i>	<.0001	<.0001
<i>moist</i>	<.0001	0.0003
<i>day</i>	<.0001	<.0001
<i>biochar*temp</i>	0.7375	0.3441
<i>biochar*moist</i>	0.2427	0.603
<i>char*day</i>	0.6844	<.0001
<i>temp*moist</i>	<.0001	<.0001
<i>temp*day</i>	<.0001	<.0001
<i>biochar*temp*moist</i>	0.7807	0.1429
<i>biochar*temp*day</i>	0.9751	<.0001
<i>biochar*moist*day</i>	0.4465	0.0794
<i>temp*moist*day</i>	<.0001	<.0001
<i>biochar*temp*moist*day</i>	0.9954	<.0001

Table S2 ANOVA statistical results from analysis cumulative post-fertilization soil incubation emissions data, presented as p-values (significance evaluated at $p < 0.05$).

Effect	CO₂	N₂O
<i>biochar</i>	0.6234	0.1878
<i>temp</i>	<.0001	<.0001
<i>moist</i>	0.0079	<.0001
<i>temp*moist</i>	<.0001	<.0001
<i>biochar*temp</i>	0.0875	0.4225
<i>biochar*moist</i>	0.0953	0.116
<i>biochar*temp*moist</i>	0.1494	0.4767

Table S3 Repeated measures statistical results from analysis of daily soil emissions data measured in the field, presented as p-values (significance evaluated at $p < 0.05$).

Effect	CO₂	N₂O
<i>block</i>	<.0001	0.0014
<i>crop</i>	<.0001	<.0001
<i>biochar</i>	0.7808	0.3695
<i>day</i>	<.0001	<.0001
<i>block*crop</i>	0.0025	0.0094
<i>block*biochar</i>	0.2598	0.2371
<i>block*day</i>	<.0001	<.0001
<i>crop*biochar</i>	0.7937	0.304
<i>crop*day</i>	<.0001	<.0001
<i>biochar*day</i>	0.3391	0.9986
<i>block*crop*biochar</i>	0.1531	0.1897
<i>block*crop*day</i>	<.0001	<.0001
<i>block*biochar*day</i>	0.3662	0.0479
<i>crop*biochar*day</i>	0.1508	0.2275
<i>block*crop*biochar*day</i>	0.5105	0.1917

Table S4 ANOVA statistical results from analysis of cumulative soil emissions data measured in the field, presented as p-values (significance evaluated at $p < 0.05$).

Effect	CO₂	N₂O
<i>crop</i>	0.0071	0.0214
<i>biochar</i>	0.8915	0.4761
<i>crop*biochar</i>	0.941	0.3378