Supplementary information

Mechanisms of enhancing soil fertility without obviously elevating global warming potential under an optimal rice straw incorporation rate in a paddy soil

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Table S1 Primer sets and thermal programs for qPCR

Target gene		Primers (5'→3')	Expected size bp	Ta °C	Primer µM	Reference
Bacterial 16S rRNA	1369F	CGGTGAATACGTTCYCGG	123	58	0.3	(Eden et al., 1991; Weisburg et al., 1991; Suzuki et al., 2000)
	1492R	GGWTACCTTGTTACGACT				
Fungal 18S rRNA	nu-SSU-0817	TTAGCATGGAATAATRRAATAGGA	382	56	1.2	(Borneman and Hartin, 2000)
	nu-SSU-1196	TCTGGACCTGGTGAGTTTCC				
mcrA	mcrAF	GGTGGTGTMGGATTCACACARTAYGCWACAGC	491	56	0.3	(Springer et al., 1995; Luton et al., 2002)
	mcrAR	TTCATTGCRTAGTTWGGRTAGTT				
pmoA	A189F	GGNGACTGGGACTTCTGG	470	56	0.3	(Holmes et al., 1995; Costello and Lidstrom, 1999)
	mb661R	CCGGMGCAACGTCYTTACC				
nirK	876F	ATYGGCGGVCAYGGCGA	180	60	0.3	(Henry et al., 2004; Chen et al., 2010)
	1055R	GCYTCGATCAGRTTRTGGTT				
nirS	cd3aF	GTSAACGTSAAGGARACSGG	423	60	0.3	(Michotey et al., 2000; Throbäck et al., 2004)
	R3cd	GASTTCGGRTGSGTCTTGA				
*nosZ*I	nosZI-1126F	GGGCTBGGGCRTTGCA	256	60	0.3	(Chen et al., 2012)
	nosZI-1381R	GAAGCGRTCCTTSGARAACTTG				
*nosZ*II	nosZII-F	CTIGGICCIYTKCAYAC	748	56	1.0	(Jones et al., 2013)
	nosZII-R	GCIGARCARAAITCBGTRC				

Ta = Annealing temperature. Thermal program: Step 1, pre-denaturation, 95°C, 2 min. Step 2, denaturation, 95°C, 15 s; annealing, Ta, 30 s; extension, 72°C, 30 s (for bacterial 16S rRNA, denaturation, 95°C, 5 s; annealing, Ta, 20 s; extension, 72°C, 20 s). Step 3, melting curve, 95°C, 15 s; 60 or 65°C, 15 s; 95°C continuous

Table S2 Cumulative emissions and global warming potential in three phases

Period	Treatment	Cumulative emissions			Global warming potential
		CO_2 ($g \cdot m^{-2}$)	CH_4 ($g \cdot m^{-2}$)	N_2O ($g \cdot m^{-2}$)	(g CO_2 equivalent$\cdot m^{-2}$)
Phase I	CK	112.52 ± 6.85 c	0.02 ± 0.00 d	1.43 ± 0.21 a	504.00 ± 63.50 bc
	ST1	166.97 ± 24.87 bc	2.14 ± 0.19 c	0.59 ± 0.20 b	386.54 ± 78.54 c
	ST2	223.69 ± 31.19 ab	16.41 ± 0.31 b	0.22 ± 0.10 b	741.59 ± 58.71 b
	ST3	274.41 ± 10.47 a	25.19 ± 0.68 a	0.24 ± 0.08 b	1041.96 ± 37.83 a
Phase II	CK	53.30 ± 3.38 c	0.04 ± 0.00 c	0.03 ± 0.00 b	63.20 ± 3.93 d
	ST1	105.91 ± 1.73 b	2.17 ± 0.51 c	0.10 ± 0.04 ab	192.64 ± 4.88 c
	ST2	134.51 ± 8.58 a	6.51 ± 1.30 b	0.16 ± 0.02 a	360.84 ± 37.59 b
	ST3	115.35 ± 2.15 ab	12.34 ± 0.50 a	0.10 ± 0.00 ab	488.09 ± 16.16 a
Phase III	CK	114.37 ± 7.71 d	0.29 ± 0.02 a	1.15 ± 0.17 bc	436.29 ± 52.09 c
	ST1	192.78 ± 10.61 c	0.09 ± 0.03 a	0.95 ± 0.10 c	455.76 ± 34.49 c
	ST2	247.72 ± 0.72 b	0.30 ± 0.08 a	1.65 ± 0.17 b	707.62 ± 50.12 b
	ST3	305.94 ± 7.38 a	0.48 ± 0.16 a	2.46 ± 0.15 a	991.43 ± 45.55 a

Phase I, Phase II, and Phase III represent the flooding period, the early drained period, and the late drained period, respectively. CK, ST1, ST2, and ST3 received 0, 50%, 100%, and 150% of the local harvested rice straw, respectively. Different lower-case letters indicate significant differences between treatments ($\alpha = 0.05$). Data are given in average ± standard error ($n = 3$).

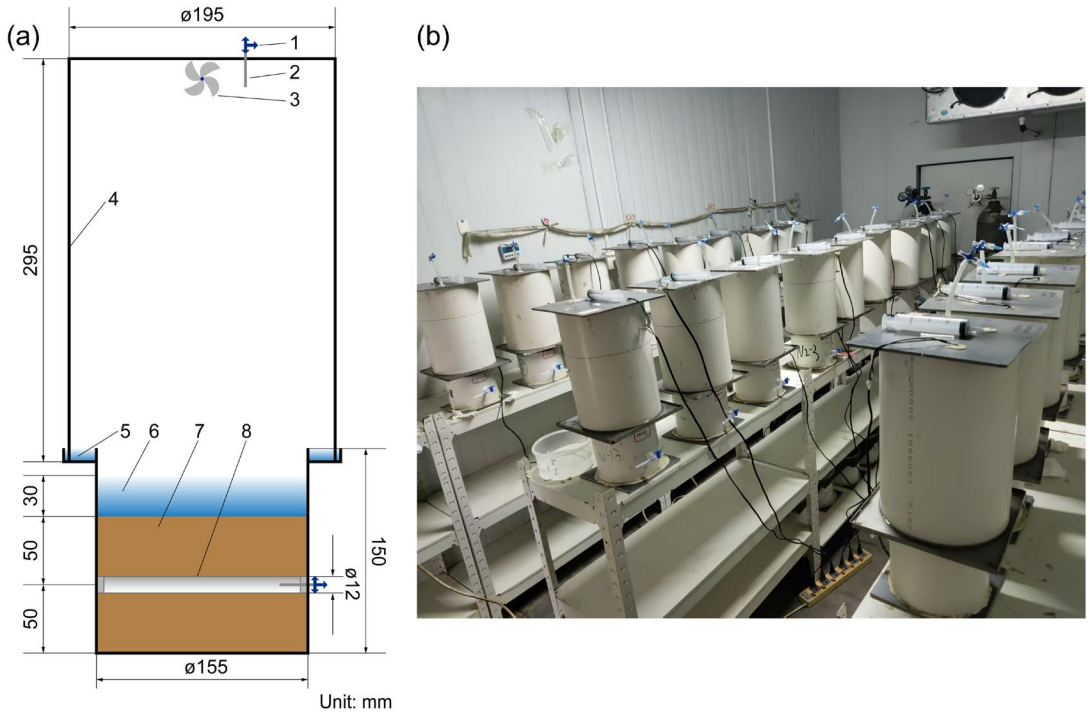

Fig. S1 (a) Simplified diagram of the gas sampling pot: 1, three-way stopcock; 2, stainless steel tube; 3, electric fan; 4, static chamber; 5, water for sealing; 6, overlying water (during flooding); 7, soil; 8, gas–permeable silicone tube (with silicone rubber stoppers at both ends). (b) Photograph of the pots during headspace gas sampling.

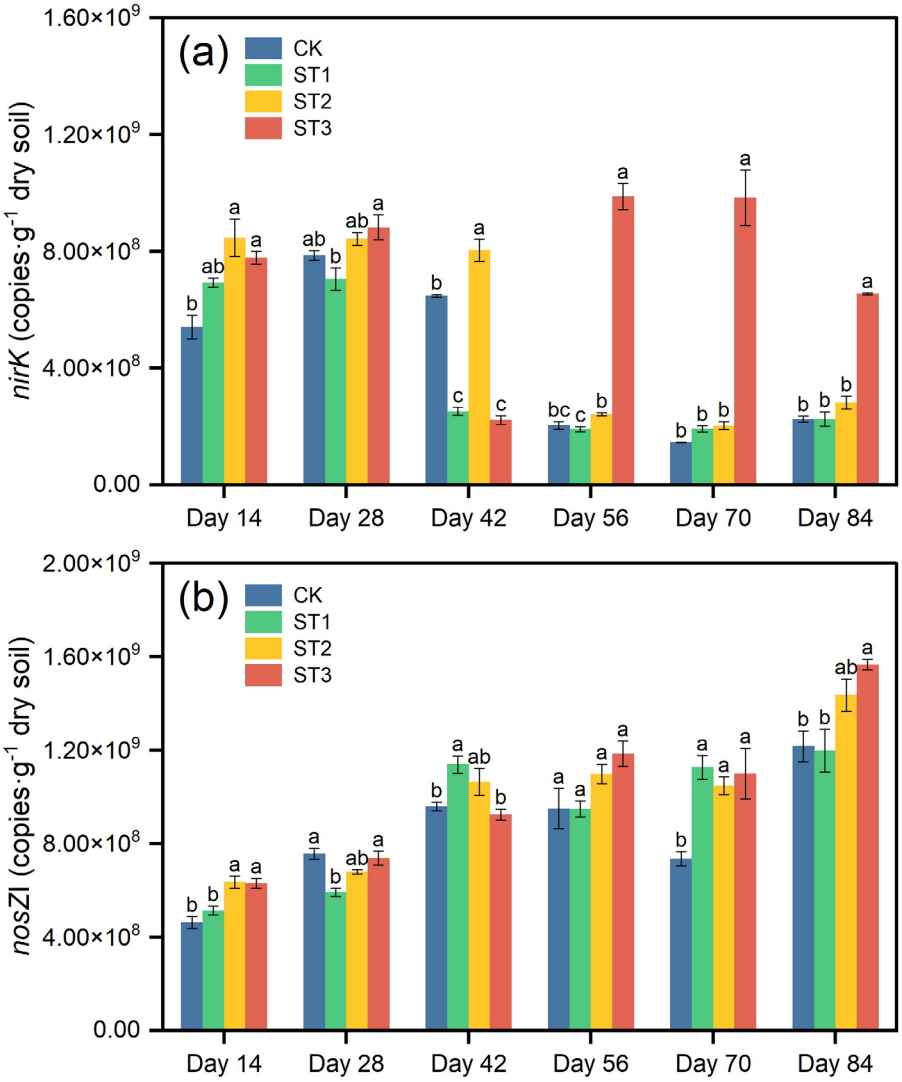

Fig. S2 Dynamics of *nirK* abundance (a) and *nosZ*I abundance (b) during the incubation. CK, ST1, ST2, and ST3 received 0, 50%, 100%, and 150% of the local harvested rice straw, respectively. Different lower-case letters denote significant differences between treatments ($\alpha = 0.05$). Data are given in average ± standard error ($n = 3$). Days 14 and 28 correspond to the flooding period, days 42 and 56 to the early drained period, and days 70 and 84 to the late drained period, respectively.

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