Supplemental material

Changes in Soil Chemical Properties and Rhizosphere Bacterial Community Induced by Soil Amendments Associated with Reduction in Cadmium Accumulation by Rice

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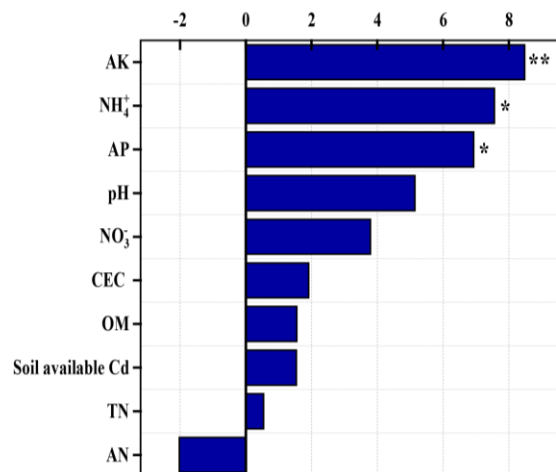
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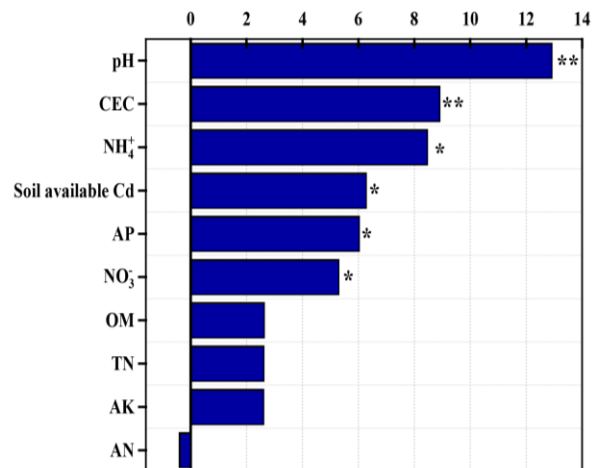† These authors contributed equally to this work.
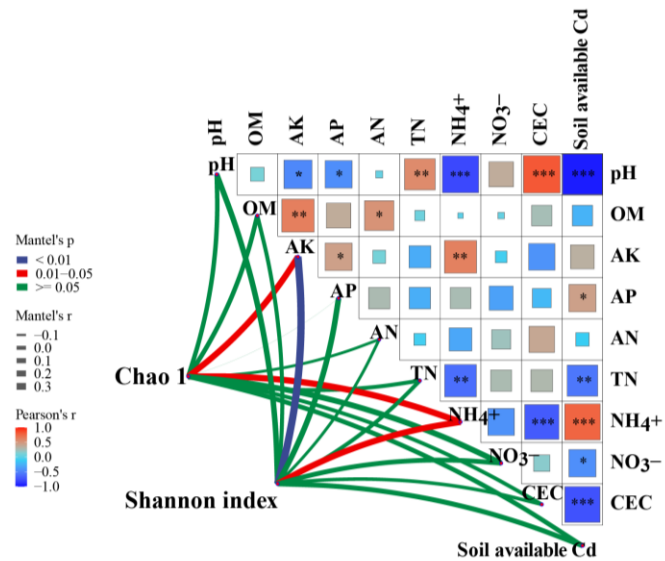
Figure S1. Multiple soil environmental variables shaping the bacterial community diversity (Chao 1 and Shannon index). (**a**) Chao 1 and Shannon index based on Bray-Curtis distance is related to each edaphic factor by Mantel test. The width of line represents the partial Mantel's r statistic and the color of line denotes the statistical significance based on 999 permutations. Pairwise correlation of environmental factors is shown by Pearson's correlations coefficient with color gradient. Bar plots show the Random Forest mean predictor importance (% of increase of MSE) of environmental drivers on Chao 1 (**b**) and Shannon index (**c**) across the amendment treatments. Significance levels of each predictor are as follows: * $P < 0.05$, ** $P < 0.01$, *** $P < 0.001$.
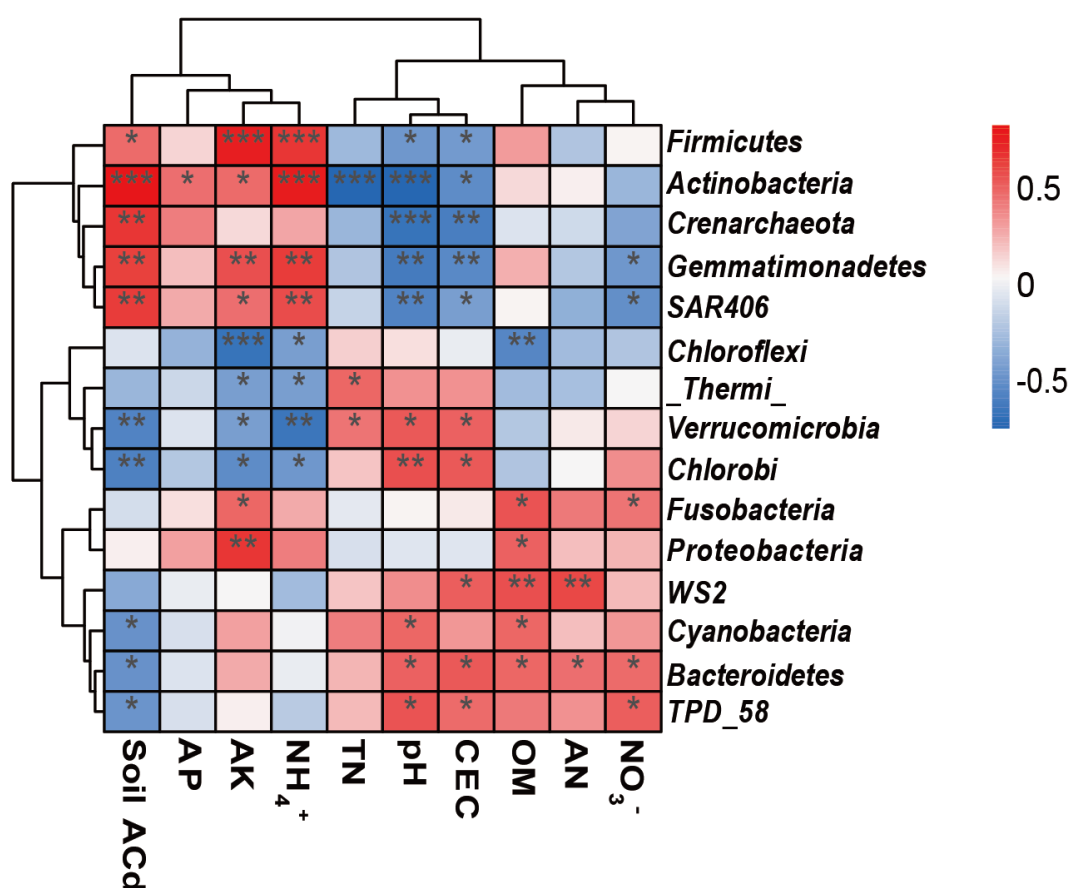
Figure S2. Pearson correlation analysis of bacterial communities and soil available Cd (Soil ACd) and soil chemical parameters. Significance levels of each predictor are as follows: * $P < 0.05$, ** $P < 0.01$, *** $P < 0.001$.

Table S1. Basic chemical properties of tested amendments.

	pH	CEC (cmol kg^{-1})	Total N (g Kg^{-1})	Total P (mg kg^{-1})	Total K (mg kg^{-1})
CaO-MgO-SiO$_2$	11.42	---	---	2.71	1.04
Biochar	8.51	19.40	2.01	8.78	2.45
CaO-MgO-Cao-SiO$_2$ + Biochar	9.13	21.22	2.13	5.32	2.11

Table S2. Effects of three soil amendments with different application rates on soil properties during rice maturity.

	Factor	Types	Dose	Types*Dose
pH	F	45.555	14.976	35.362
	P	<0.001	<0.01	<0.001
OM	F	10.225	16.41	12.287
	P	<0.01	<0.01	<0.001
CEC	F	21.168	19.521	20.619
	P	<0.001	<0.01	<0.001
TN	F	1.584	0.212	1.127
	P	0.24	0.652	0.372
NH_4^+	F	26.451	5.286	19.396
	P	<0.001	<0.05	<0.001
NO_3^-	F	0.95	0.003	0.634
	P	0.41	0.957	0.605
AN	F	0.437	2.014	0.962
	P	0.655	0.178	0.438
AP	F	11.644	0.79	8.026
	P	<0.01	0.389	<0.01
AK	F	40.049	10.887	30.328
	P	<0.001	<0.01	<0.001

The F value and significance of the effects of experimental factors were determined by two-way analysis of variance.

Table S3. Effects of three soil amendments with different application rates on soil Cd availability, total Cd accumulation in straw and rice grain at the mature stage of rice.

	Factor	Types	Dose	Types*Dose
Soil available Cd	F	16.407	8.862	13.892
	P	<0.001	<0.05	<0.001
Straw Cd	F	5.203	38.337	16.248
	P	<0.05	<0.001	<0.001
Rice grain Cd	F	7.088	33.506	15.894
	P	<0.01	<0.001	<0.001

The F value and significance of the effects of experimental factors were determined by two-way analysis of variance.

Table S4. Effects of three soil Soil available Cd with different application rates on bacteria α-diversity (chao1 index and Shannon index) and β-diversity (PC1) at the mature stage of rice

	Factor	Types	Dose	Types*Dose
Chao1	F	6.427	1.424	4.759
	P	<0.05	0.253	<0.05
Shannon	F	24.101	1.977	16.727
	P	<0.001	0.181	<0.001
PC1	F	11.823	2.603	8.75
	P	<0.01	0.129	<0.01

The F value and significance of the effects of experimental factors were determined by two-way analysis of variance.

Table S5. The network properties of bacterial taxonomic groups in soil at the phylum level by different application of three soil amendments.

Network parameters	Number of nodes	Number of edges	Average degree	Average clustering coefficient	Network diameter	Network density	Average path length	+	-
CK	48	1071	44.625	0.918	2	0.949	1.093	589	482
A150	49	1140	46.531	0.934	2	0.969	1.072	628	512
A300	50	1183	47.32	0.928	2	0.966	1.075	621	562
B150	50	1160	46.4	0.911	2	0.947	1.094	611	549
B300	51	1266	49.647	0.955	2	0.993	1.047	671	595
C150	53	1274	48.075	0.893	2	0.925	1.114	648	626
C300	48	1107	46.125	0.942	2	0.981	1.061	535	572