

***Supporting Information***

**Effects of an additive (hydroxyapatite–bentonite–biochar) on Cd and Pb stabilization and microbial community composition in contaminated vegetable soil**

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**The specific methods for soil pH, SOC, available N, P and K were described as follows.**

Soil pH was determined using 1:2.5 (*w/v*) soil to water ratio and measured by pH meter (Orion Star™ A211, USA). SOC was determined by the potassium dichromate oxidation ( $K_2Cr_2O_7-H_2SO_4$ ) spectrophotometric method. The available nitrogen was determined by the alkali-diffusion method. The available phosphorus was measured by treatment with  $0.5 \text{ mol L}^{-1} NaHCO_3$  (pH 8.5) followed by molybdenum blue colorimetry method. The available potassium was measured by  $1 \text{ mol L}^{-1} NH_4OAc$  extraction-flame photometry.

**Descriptions of the European Community Bureau of Reference (BCR) sequential extraction method**

Briefly, step 1—acid-soluble fraction; 40 mL of  $0.11 \text{ mol L}^{-1}$  acetic acid (HAc) was added into in a 100-mL polyvinyl centrifuge tube already containing 1.0 g soil, and then shaken for 16 h to reach equilibrium. After that, the suspension was centrifuged at 4000 revolutions per minute (rpm) for 20 min. The supernatant was stored at 4 °C for further analysis. The soil pellet was washed with Milli-Q water and used for further extraction. Step 2—reducible fraction; 40 mL of  $0.1 \text{ mol L}^{-1}$  hydroxylamine hydrochloride ( $NH_2OH \cdot HCl$ , acidified at pH 2) for Fe/Mn-bound metal fraction was added in the residual soil pellet of step 1, and then shaken and centrifuged and the filtrate was stored at 4 °C. The soil pellet was washed with Milli-Q water and used for further extraction. Step 3—oxidizable fraction; 10 mL of 30% (*m/v*)  $H_2O_2$  was added into soil pellet and allowed standing for 1 h at 85°C on water bath. Another 10 mL of 30% (*m/v*)  $H_2O_2$  was used to digest sample at 85 °C. Then, the soil was extracted with 50 mL of  $1 \text{ mol L}^{-1}$  of ammonium acetate ( $NH_4OAc$ ) at pH 2 as described in step 1. After the third step, residual washed and air-dried soil was digested with the mixture of 10 mL  $HNO_3$ , 10 mL HF and 3 mL  $HClO_4$  to extract the final residual fraction.

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Table S1 Pearson correlation coefficients between soil physicochemical indexes and relative abundances of the most abundant phylum

phylum	class	pH	SOC	N <sub>-available</sub>	P <sub>-available</sub>	K <sub>-available</sub>	Cd <sub>-available</sub>	Pb <sub>-available</sub>
<i>Proteobacteria</i>	<i>α-Proteobacteria</i>	-0.804*	-0.425	-0.397	-0.224	-0.218	0.769*	0.745*
	<i>β-Proteobacteria</i>	0.583	0.356	-0.139	-0.216	0.175	-0.464	-0.471
	<i>γ-Proteobacteria</i>	-0.796*	-0.564	-0.472	-0.361	-0.385	0.689*	0.662*
	<i>δ-Proteobacteria</i>	0.347	0.291	-0.185	0.223	0.147	-0.194	-0.242
<i>Acidobacteria</i>	<i>Acidobacteria_Gp1</i>	-0.445	-0.141	-0.156	-0.310	-0.295	0.596*	0.577*
	<i>Acidobacteria_Gp7</i>	0.709*	0.676*	0.574*	0.279	0.130	-0.801*	-0.594*
	<i>Acidobacteria_Gp16</i>	0.846*	0.637*	0.264	0.129	-0.224	-0.849*	-0.570*
	<i>Holophagae</i>	-0.421	-0.243	-0.214	-0.335	-0.289	0.454	0.467
<i>Bacteroidetes</i>	<i>Bacteroidetes_unclassified</i>	0.647*	0.337	0.283	0.188	0.292	-0.219	-0.158
	<i>Flavobacteria</i>	0.793*	0.558*	0.377	0.283	0.214	-0.517*	-0.521*
	<i>Sphingobacteria</i>	-0.524	-0.225	-0.216	-0.147	-0.138	0.557*	0.513
<i>Actinobacteria</i>	<i>Actinobacteria</i>	-0.749*	-0.524	0.378	0.488	-0.501	0.653*	0.617*
<i>Chloroflexi</i>	<i>Anaerolineae</i>	0.327	0.368	0.429	0.166	0.271	-0.372	-0.368
	<i>Caldilineae</i>	0.593	0.359	0.379	0.105	0.556*	-0.293	-0.452
<i>Gemmatimonadetes</i>	<i>Gemmatimonadetes</i>	-0.474	-0.305	-0.298	-0.268	-0.159	0.297	0.272
<i>Nitrospirae</i>	<i>Nitrospira</i>	-0.396	-0.246	-0.268	-0.391	-0.249	0.428	0.304
<i>Cyanobacteria</i>	<i>Cyanobacteria</i>	-0.238	0.252	0.152	0.309	0.169	-0.267	-0.180
<i>Firmicutes</i>	<i>Bacilli</i>	0.287	0.385	0.243	0.364	0.318	-0.389	-0.222
	<i>Clostridia</i>	0.311	0.276	0.129	0.216	0.133	-0.264	-0.187
<i>Latescibacteria</i>	<i>Latescibacteria_unclassified</i>	0.728*	0.603*	0.454	0.378	0.369	0.243	0.315

SOC: Soil organic carbon; N<sub>-available</sub>: available nitrogen concentration; P<sub>-available</sub>: available phosphorus concentration; K<sub>-available</sub>: available potassium concentration; Cd<sub>-available</sub>: available cadmium concentration; Pb<sub>-available</sub>: available lead concentration. \* Correlation is significant at the 0.05 level.

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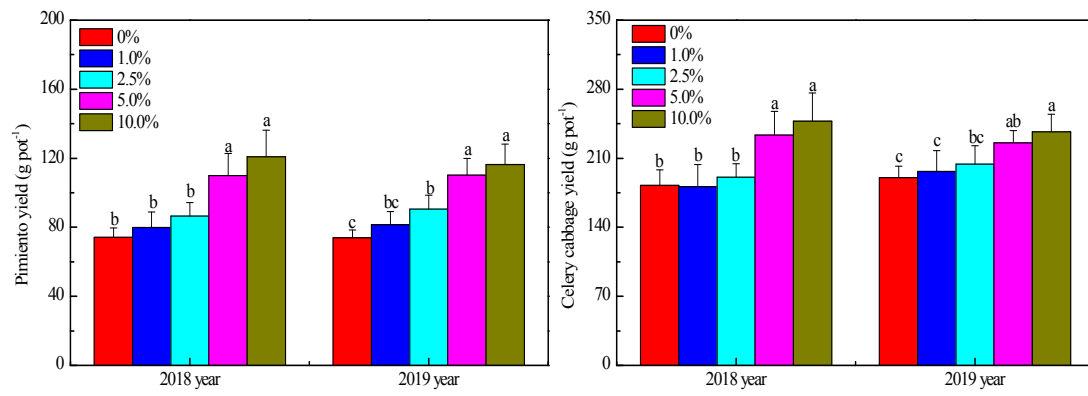


Fig. S1 Edible part yields of pimiento and celery cabbage in tested soil with different application rates of HTB. Values are mean  $\pm$  SD, and different lower case letters between bars indicate significant difference at  $p < 0.05$  level ( $n = 3$ , LSD test).