Supporting information

Table legends

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Table S1. Approximate number of soil-borne pathogens before soil anaerobic disinfestation.

Greenhouses	*Fusarium* spp. (cfu/g soil)	*Phytophthora* spp. (cfu/g soil)
Trial I	4,955	6,539
Trial II	4,955	6,789

Table S2. Properties of rice bran and biochar materials.

Material	Feedstock	Pyrolysis Temp. (°C)	C (%)	N (%)	C/N	Source
Rice bran	By-products of rice processing	None applied	41.93	1.47	28.52	Chengde Rice Processing Factory, Hebei, China..
Biochar	Rice husk charcoal	~500	50.43	0.93	54.23	Huateng Biochar Co., Ltd., Guizhou, China.

Table S3. Culture medium composition (making 2 L of culture medium)[a]

	Ingredients	Composition
Fusarium spp.	A	K_2HPO_4 (2 g), KCl (1 g), MgSO4 (1 g), L-Asparagine (4 g), D Galactose (40 g), Agar (30 g).
	B	Fe-Na EDTA (0.02 g), $Na_2B_4O_7.10H_2O$ (2 g), Oxgall (1 g), Streptomycin sulfate (1 g), Pentachloronitrobenzene (PCNB) (1.5 g).
Phytophthora spp.	A	Agar (34 g), Glucose (40 g).
	B	Pentachloronitrobenzene (PCNB) (0.15 g), Ampicillin (0.03 g), Rifampicina (0.02 g).

[a] Take the amount of 2 L as an example. The ingredients in A were added to 1.9 L distilled water, boiled, packed and then sterilized. The ingredients in B were directly added to 100 mL of sterilized water and shaken.

Table S4. Soil-borne pathogen abundance and mortality 10 days in the different treatments[a].

Treatment	Trial I				Trial II			
	Fusarium spp. (cfu/g soil)	Mortality (%)	*Phytophthora* spp. (cfu/g soil)	Mortality (%)	*Fusarium* spp. (cfu/g soil)	Mortality (%)	*Phytophthora* spp. (cfu/g soil)	Mortality (%)
CK	2108±314a	/	3312±424a	/	10255±1284a	/	9078±539a	/
ST	532±105b	74.76	484±39b	85.39	3173±285b	69.06	3338±398b	63.23
RB10	285±69bc	86.48	225±16bc	93.21	349±92c	96.60	208±38d	97.71
RB20	316±37bc	85.01	269±67bc	91.88	424±58c	95.87	368±14d	95.95
BC5	458±70b	78.27	354±19bc	89.31	1082±141c	89.45	1190±147c	86.89
BC10	165±20c	92.17	87±13c	97.37	145±19c	98.59	159±38d	98.25

[a] Means (N = 3) within the same column accompanied by the different letters indicate significant differences between treatments (P ⩽ 0.05). CK＝No rice bran or biochar added to the soil and no film applied; ST＝Soil covered by TIF without rice bran or biochar; RB10＝10 t/ha rice bran plus TIF; RB20＝20 t/ha rice bran plus TIF; BC5＝5 t/ha biochar plus TIF; BC10＝10 t/ha biochar plus TIF.

Table S5. Soil-borne pathogen abundance 120 days in the different treatments[a].

Treatment	Trial I		Trial II	
	Fusarium spp. (cfu/g soil)	*Phytophthora* spp. (cfu/g soil)	*Fusarium* spp. (cfu/g soil)	*Phytophthora* spp. (cfu/g soil)
CK	1070±49a	1275±58a	1290±79a	2514±57a
ST	1079±30a	1268±48a	1238±30a	2503±88a
RB10	1008±16a	1242±55a	1246±61a	2459±44a
RB20	1041±48a	1253±50a	1284±85a	2480±69a
BC5	1044±45a	1297±48a	1311±71a	2460±52a
BC10	1043±43a	1206±51a	1200±35a	2447±6a

[a] Means (N = 3) within the same column accompanied by the different letters indicate significant differences between treatments (P $\leqslant$ 0.05).The treatments are described in Table S3.

Table S6. Strawberry plant height, stem diameter and plant mortality, and strawberry fruit yield in the different treatments[a].

Treatment	Trial I				Trial II			
	Plant height (cm)	Stem diameter (mm)	Plant mortality (%)	Strawberry fruit yield (t/ha)	Plant height (cm)	Stem diameter (mm)	Plant mortality (%)	Strawberry fruit yield (t/ha)
CK	14.25±0.73b	18.58±0.68b	11.50±1.29a	2.35±0.23e	26.58±2.36c	23.46±0.53b	8.75±0.96a	2.85±0.10e
ST	19.59±1.80a	21.92±1.74ab	6.75±0.96b	3.46±0.20d	29.35±3.33bc	30.86±3.37a	6.50±0.58b	3.97±0.08d
RB10	18.49±2.80a	18.94±2.35ab	5.00±1.41c	4.90±0.13b	33.50±3.84a	29.56±1.72a	4.75±0.96c	5.40±0.20b
RB20	18.49±3.19a	21.18±6.23ab	2.25±0.50d	4.17±0.38c	33.08±1.51ab	31.15±3.14a	2.25±0.96d	4.67±0.15c
BC5	20.00±3.16a	20.84±4.02ab	2.75±0.96d	3.69±0.08d	32.85±1.70ab	31.30±3.58a	2.25±0.50d	4.21±0.21d
BC10	21.15±2.29a	24.73±3.97a	3.00±1.41d	5.45±0.29a	34.16±1.11a	33.04±1.97a	1.75±0.50d	5.96±0.07a

[a] Means (N = 3) within the same column accompanied by the different letters indicate significant differences between treatments (P ≤ 0.05). The treatments are described in Table S3.

Figure legends

Figure S1. Nonmetric Multidimensional Scale Analysis of soil (A) bacterial and (B) fungal communities exposed to different treatments.

Figure S2. Heatmap analysis of correlations between soil (A) bacterial and (B) fungal communities at the genus level with soil physicochemical properties.

Figure S3. Ordinal regression analysis of alpha diversity and pH of soil bacterial (A, C) and fungal (B, D) communities. R2 is the coefficient of determination which represents the proportion of variation explained by the regression line.

Figure S4. Correlation analysis between strawberry yield and soil physicochemical properties.

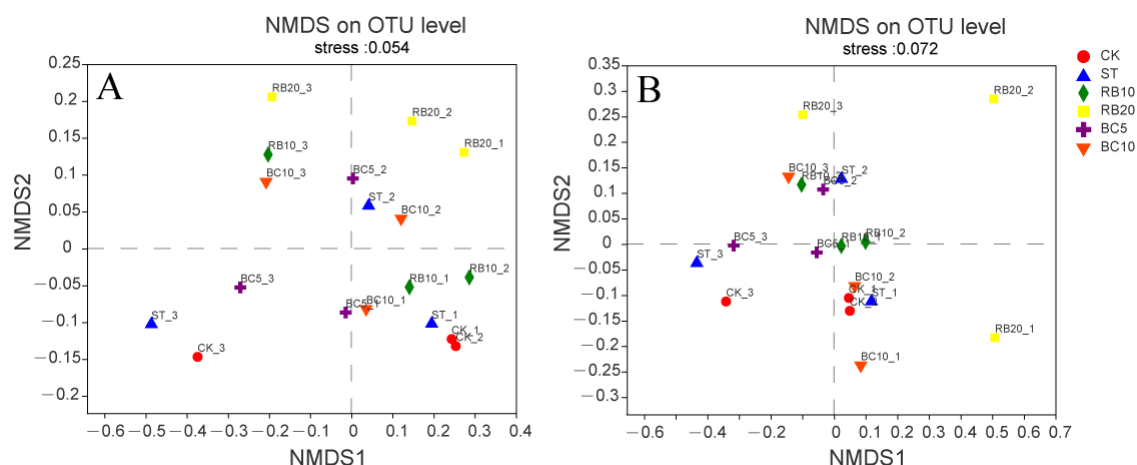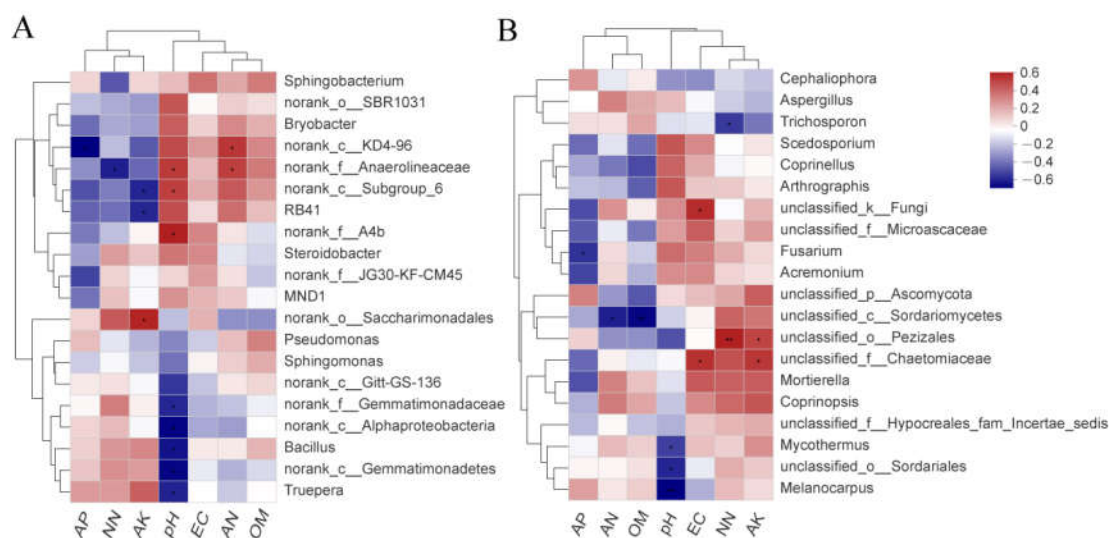Figure S5. Correlation analysis between strawberry yield and soil-borne pathogens.

Figure S1. Nonmetric Multidimensional Scale Analysis of soil (**A**) bacterial and (**B**) fungal communities exposed to different treatments. CK＝No rice bran or biochar added to the soil and no film applied; ST＝Soil covered by TIF without rice bran or biochar; RB10＝10 t/ha rice bran plus TIF; RB20＝20 t/ha rice bran plus TIF; BC5＝5 t/ha biochar plus TIF; BC10＝10 t/ha biochar plus TIF.

Figure S2. Heatmap analysis of correlations between soil (**A**) bacterial and (**B**) fungal communities at the genus level with soil physicochemical properties. Correlation analysis was performed using Spearman's rank correlation method. Red represents a positive correlation and blue represents a negative correlation. Significance levels: * $p < 0.05$, ** $p < 0.01$. The treatments are described in Figure S1.
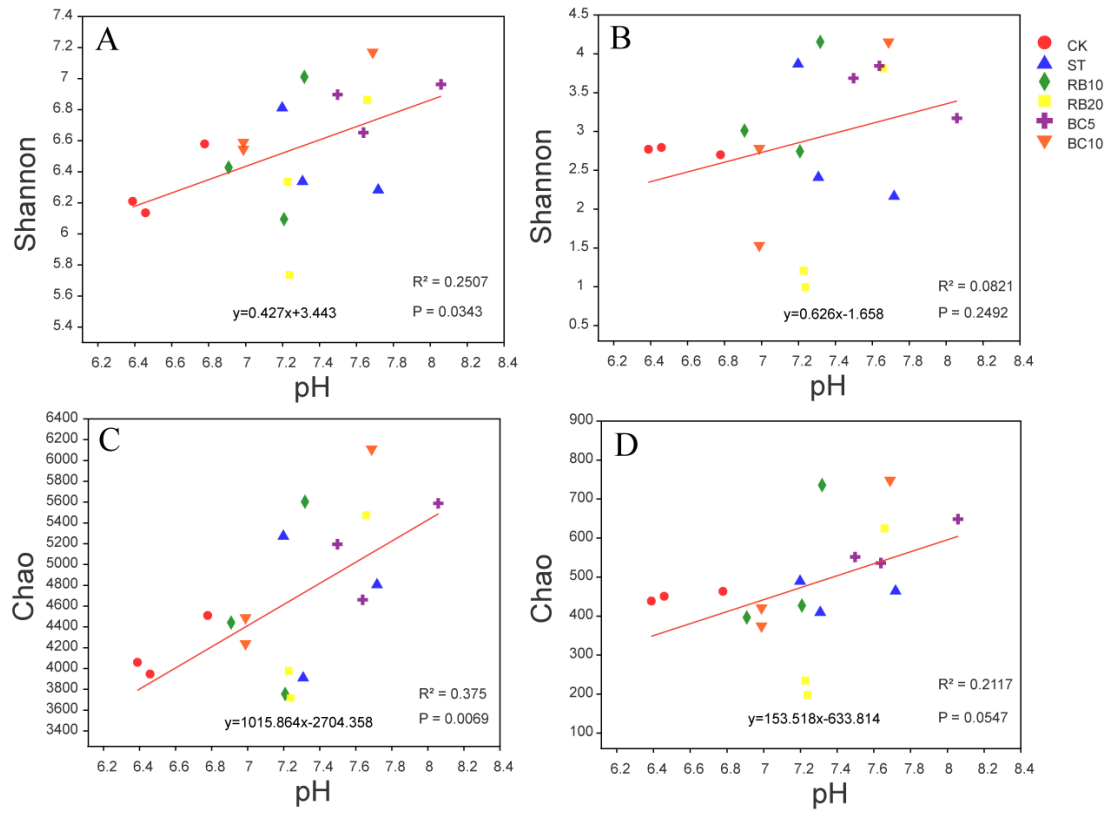
Figure S3. Ordinal regression analysis of alpha diversity and pH of soil bacterial (**A, C**) and fungal (**B, D**) communities. R^2 is the coefficient of determination which represents the proportion of variation explained by the regression line. The larger the R^2, the higher the likelihood that pH influences the alpha diversity. The treatments are described in Figure S1.
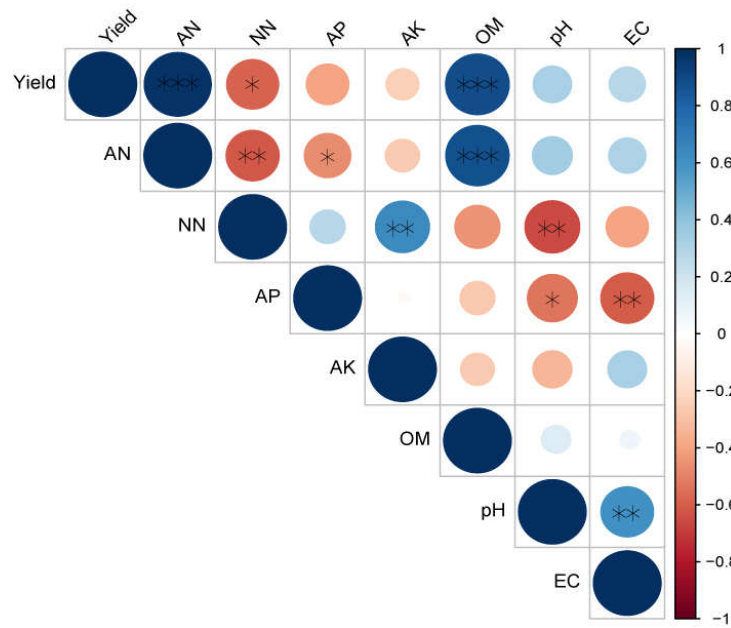
Figure S4. Correlation analysis between strawberry yield and soil physicochemical properties. Soil properties are defined in Table S2. Correlation analysis was performed using Spearman's rank correlation method. Blue represents a positive correlation and red represents a negative correlation. Significance levels: * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$. Abbreviations: AN, $NH4^+$-N; NN, NO_3^--N; AP, available phosphorus; AK, available potassium; OM, organic matter; EC, electrical conductivity.
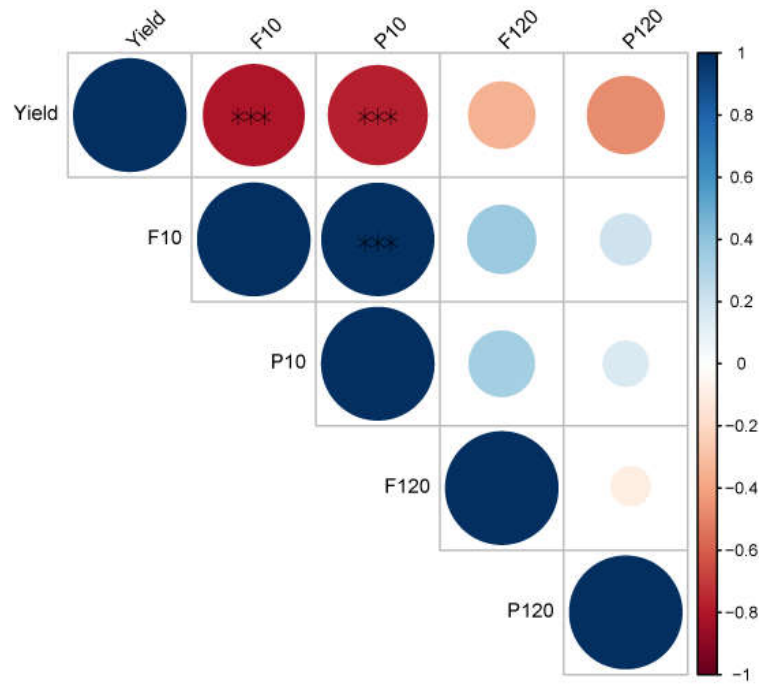
Figure S5. Correlation analysis between strawberry yield and soil-borne pathogens. Correlation analysis was performed using Spearman's rank correlation method. Blue represents a positive correlation and red represents a negative correlation. F10 = *Fusarium spp.* abundance 10 d after ASD; F120 = *Fusarium spp.* abundance 120 d after ASD; P10 = *Phytophthora spp.* abundance 10 d after ASD; P120 = *Phytophthora spp.* abundance 120 d after ASD. Significance levels: *** *p* < 0.001.