

Supporting Information

Table S1. Decomposition rate of the residues of different biomass weight

Sample	Residue biomass (g L ⁻¹)	Initial mass (g)	Residual mass (g)	Average decomposition rate (g d ⁻¹)	Decomposition rate (%)
B1	0	0	0	0	0
B2	0.1	2.5	≈0	0.041	≈100
B3	0.3	7.5	0.656	0.112	91.2
B4	0.5	12.5	1.020	0.188	91.8

Table S2. Decomposition rate of the residues of different sediment component

Sample	Residue biomass (g L ⁻¹)	Initial mass (g)	Residual mass (g)	Average decomposition rate (g d ⁻¹)	Decomposition rate (%)
S1	0.3	7.5	0.382	0.117	94.9
S2	0.3	7.5	0.718	0.111	90.4
S3	0.3	7.5	0.364	0.117	95.1
S4	0.3	7.5	0.494	0.115	93.4

Table S3. Decomposition rate of the residues by living *V. spinulosa* Yan

Sample	Residue biomass (g L ⁻¹)	Initial mass (g)	Residual mass (g)	Average decomposition rate (g d ⁻¹)	Decomposition rate (%)
V1	0.3	7.5	0.641	0.112	91.5
V2	0.3	7.5	0.575	0.114	92.3
V3	0.3	7.5	0.127	0.121	98.3
V4	0.3	7.5	0.254	0.119	96.6

Table S4. Summary of Good's coverage and microbial α -diversity indices of sediments and residues in different biomass weight

Sample	Name	Sobs	Ace	Chao	Shannon
B1 sediment	B1S	842	940.408	955.478	5.246
B2 sediment	B2S	834	981.303	1032.730	5.245
B3 sediment	B3S	913	1056.756	1090.119	5.209
B4 sediment	B4S	855	984.458	1003.046	5.155
B3 residue	B3PR	1034	1294.833	1315.242	4.510
B4 residue	B4PR	1209	2191.581	1876.599	4.637

Table S5. Summary of Good's coverage and microbial α -diversity indices of sediments and residues at different sediment component

Sample	Name	Sobs	Ace	Chao	Shannon
S1 sediment	S1S	764	899.978	917.000	5.056

S2 sediment	S2S	737	781.801	779.045	5.305
S3 sediment	S3S	955	1053.983	1065.359	5.381
S4 sediment	S4S	952	1061.675	1054.027	5.304
S1 residue	S1PR	2643	4852.706	4069.393	5.380
S2 residue	S2PR	839	1428.465	1280.850	4.254
S3 residue	S3PR	2235	4559.811	3683.135	5.119
S4 residue	S4PR	2275	4409.770	3485.015	4.730

Table S6. Summary of Good's coverage and microbial α -diversity indices of sediments and residues by living *V. spinulosa* Yan

Sample	Name	Sobs	Ace	Chao	Shannon
V1 sediment	V1S	913	1056.756	1090.119	5.209
V2 sediment	V2S	821	901.931	916.857	5.459
V3 sediment	V3S	918	1024.528	1046.693	5.295
V4 sediment	V4S	974	1098.305	1119.350	5.416
V1 residue	V1PR	1412	2578.998	2174.524	5.106
V2 residue	V2PR	990	1326.833	1389.558	4.999
V3 residue	V3PR	1078	1897.938	1547.412	4.286
V4 residue	V4PR	891	1807.889	1411.869	4.142

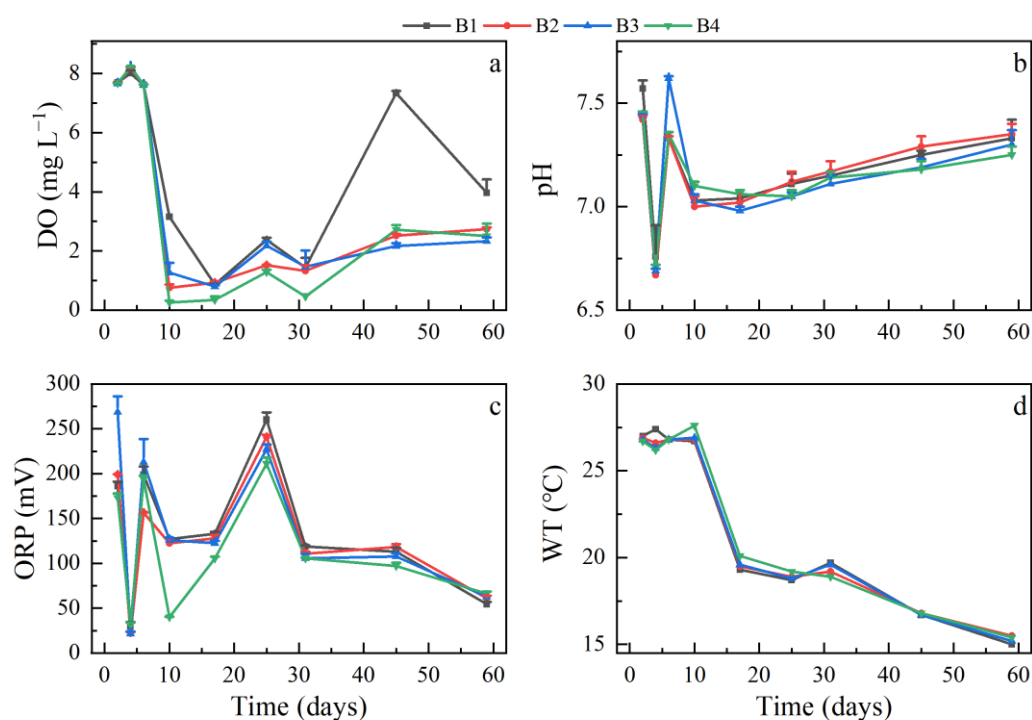


Fig.S1. Effects of different biomass weight on physicochemical properties: DO (a), pH (b), ORP (c), WT (d). B1: 0 g L⁻¹; B2: 0.1 g L⁻¹; B3: 0.3 g L⁻¹; B4: 0.5 g L⁻¹.

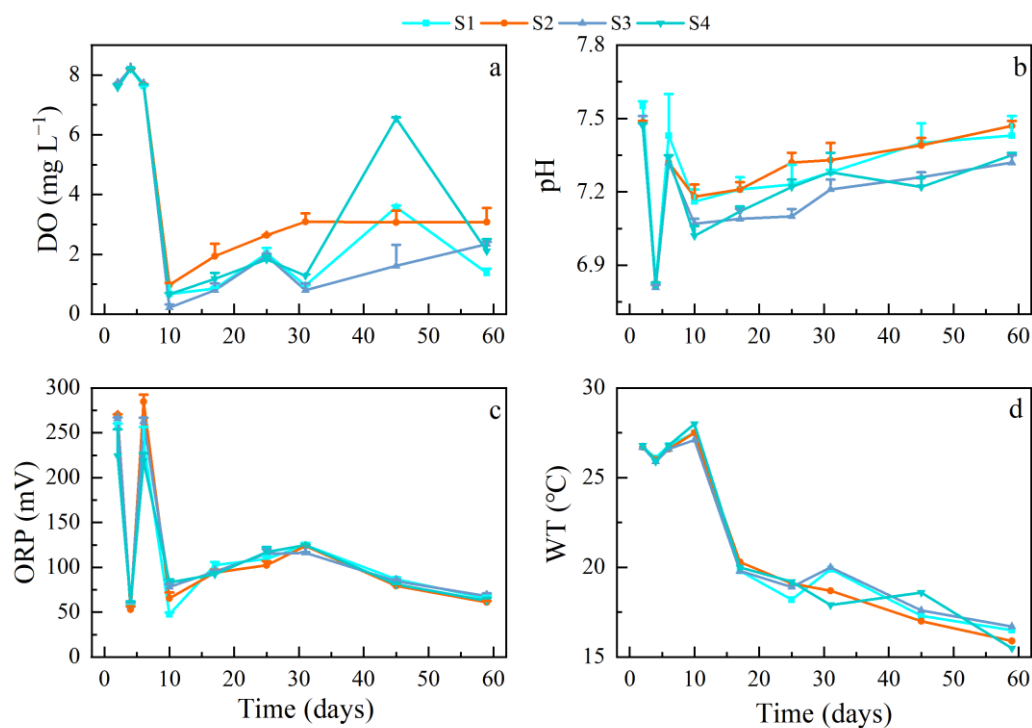


Fig.S2. Effects of different sediment component on physicochemical properties: DO (a), pH (b), ORP (c), WT (d). S1: soil; S2: sand:soil = 3:7; S3: bioceramic:soil = 3:7; S4: Fe-C ceramic:soil = 3:7.

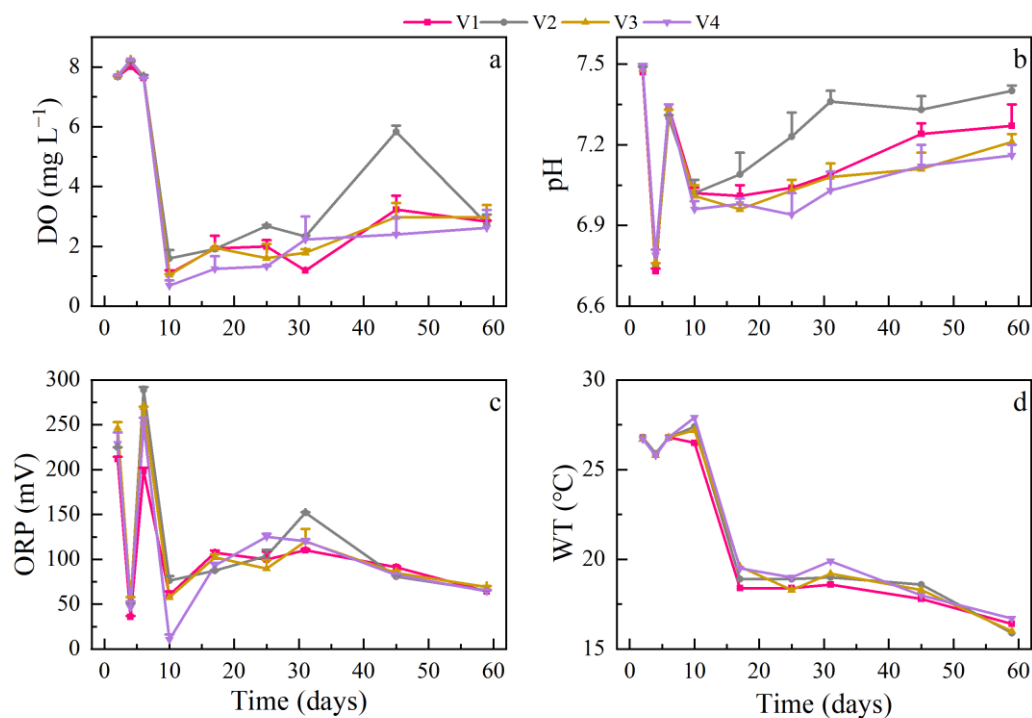


Fig.S3. Effects of living *V. spinulosa* Yan on physicochemical properties: DO (a), pH (b), ORP (c), WT (d). V1: *V. spinulosa* Yan + soil; V2: *V. spinulosa* Yan + sand:soil = 3:7; V3: *V. spinulosa* Yan + bioceramic:soil = 3:7; V4: *V. spinulosa* Yan + Fe-C ceramic:soil = 3:7.

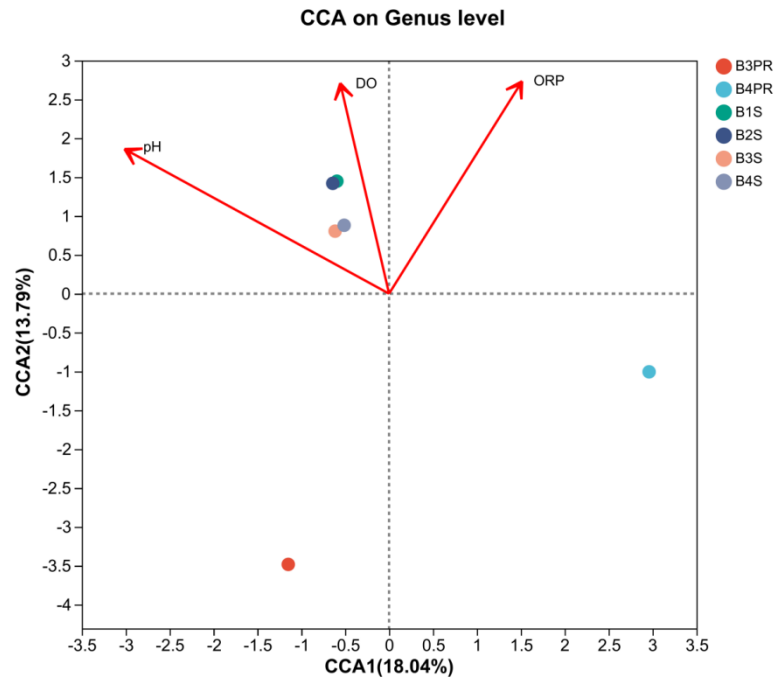


Fig.S4. CCA analysis of environmental factors and microbial community composition at the different biomass weight. The abbreviations of 'B' represent the samples collected in the groups with only soil and 180 plants/m² of living *V. spinulosa* Yan. B1S: microorganisms on sediment surface without plant residue; B2S: microorganisms on sediment surface with 0.1 g L⁻¹ of plant residues; B3S: microorganisms on sediment surface with 0.3 g L⁻¹ of plant residues; B4S: microorganisms on sediment surface with 0.5 g L⁻¹ of plant residues; B3PR: microorganisms on plant residue surface with 0.3 g L⁻¹ of plant residues; B4PR: microorganisms on plant residue surface with 0.5 g L⁻¹ of plant residues.

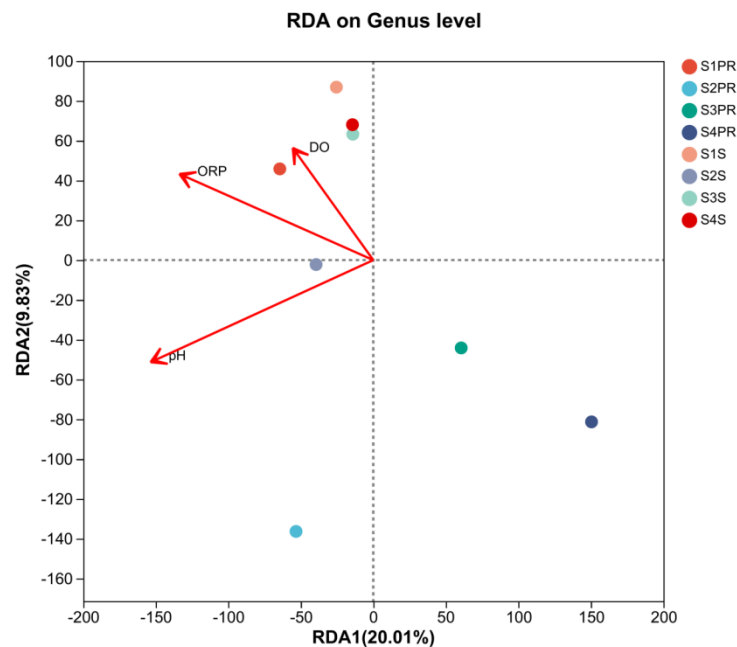


Fig.S5. CCA analysis of environmental factors and microbial community composition at the different sediment component. The abbreviation 'S' refers to the samples collected from groups containing 0.3 g L⁻¹ of plant residues and different types of sediments, but without living *V. spinulosa* Yan.

S1PR: microorganisms on the plant residue surface (only soil); S2PR: microorganisms on the plant residue surface (sand:soil = 3:7); S3PR: microorganisms on the plant residue surface (bioceramic:soil = 3:7); S4PR: microorganisms on the plant residue surface (Fe-C ceramic:soil = 3:7); S1S: microorganisms on the sediment surface (only soil); S2S: microorganisms on the sediment surface (sand:soil = 3:7); S3S: microorganisms on the sediment surface (bioceramic:soil = 3:7); S4S: microorganisms on sediment surface (Fe-C ceramic:soil = 3:7).

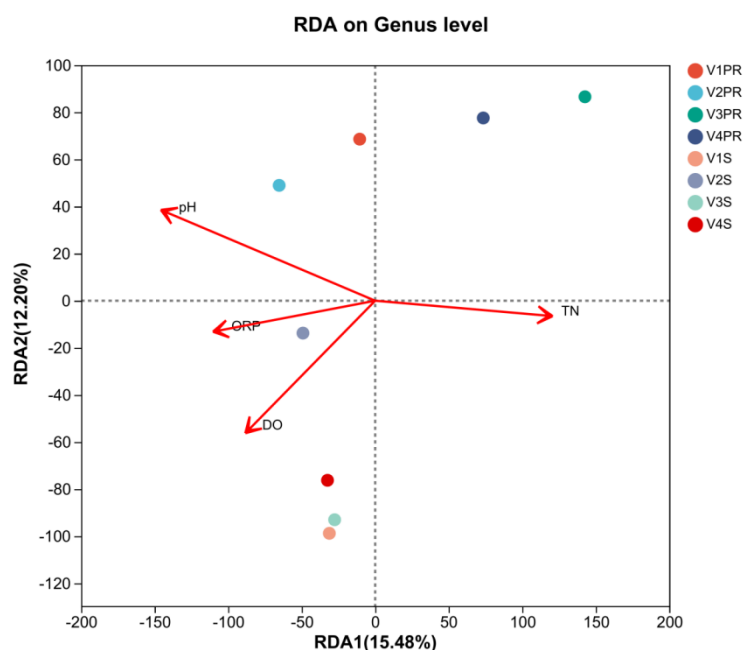


Fig.S6. CCA analysis of environmental factors and microbial community composition after planting living *V. spinulosa* Yan. The abbreviations of 'V' represent the samples collected in the groups with 0.3 g L^{-1} of plant residues, 180 plants/m^2 of living *V. spinulosa* Yan, and different sediments.

V1PR: microorganisms on the plant residue surface (only soil); V2PR: microorganisms on the plant residue surface (sand:soil = 3:7); V3PR: microorganisms on the plant residue surface (bioceramic:soil = 3:7); V4PR: microorganisms on the plant residue surface (Fe-C ceramic:soil = 3:7); V1S: microorganisms on the sediment surface (only soil); V2S: microorganisms on the sediment surface (sand:soil = 3:7); V3S: microorganisms on the sediment surface (bioceramic:soil = 3:7); V4S: microorganisms on the sediment surface (Fe-C ceramic:soil = 3:7).

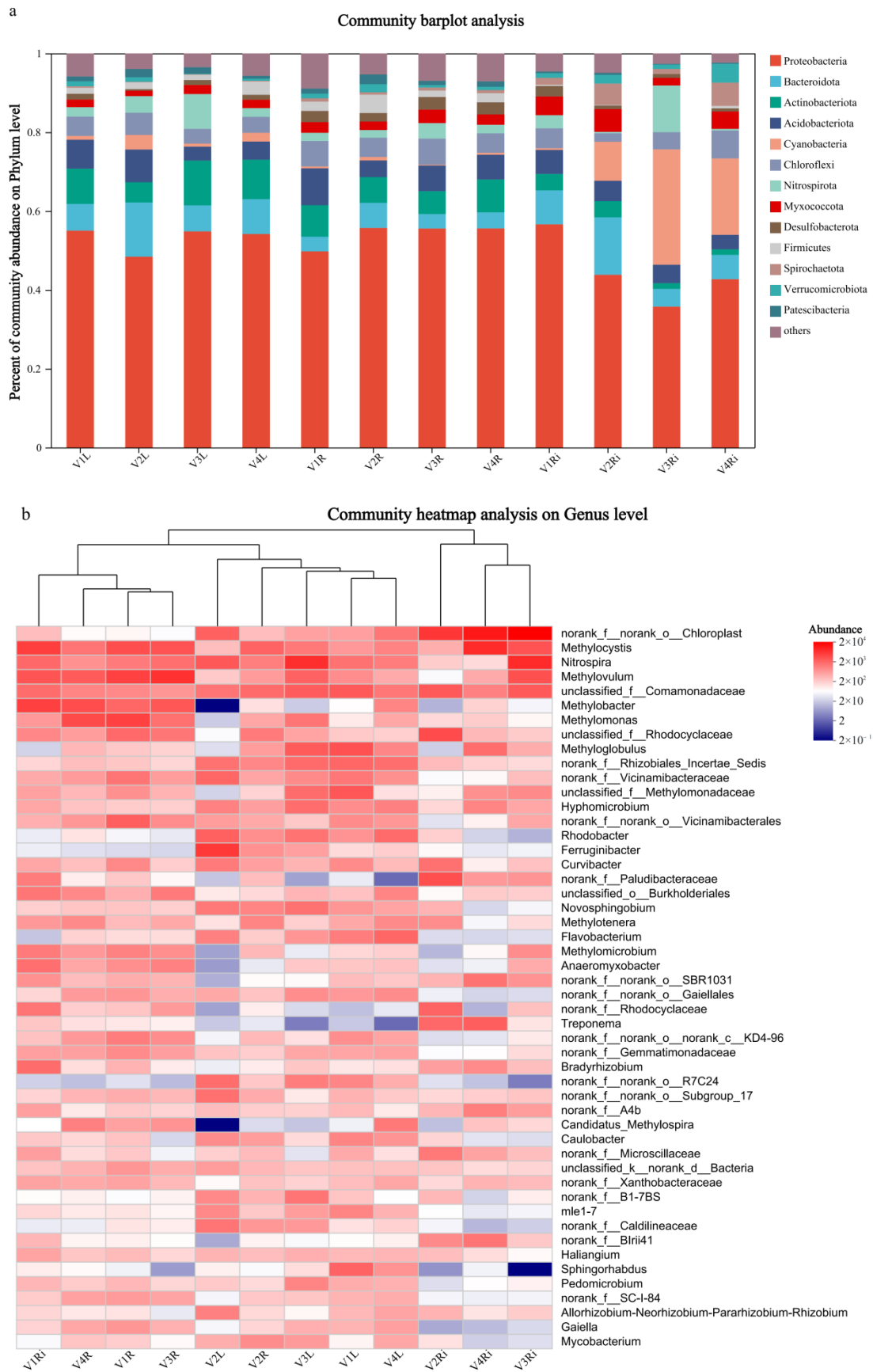


Fig. S7. Microbial community composition of leaf surface, root surface and interior after planting living

V. spinulosa Yan. **(a)** Histogram at phylum level, and **(b)** heatmap at genus level. The abbreviations of 'V' represent the samples collected in the groups with 0.3 g L⁻¹ of plant residues, 180 plants/m² of living *V. spinulosa* Yan, and different sediments. V1Ri: microorganisms within the root system (only soil); V2Ri: microorganisms within the root system (sand:soil = 3:7); V3Ri: microorganisms within the root system (bioceramic:soil = 3:7); V4Ri: microorganisms within the root system (Fe-C ceramic:soil = 3:7); V1R: microorganisms on the surface of the root system (only soil); V2R: microorganisms on the surface of the root system (sand:soil = 3:7); V3R: microorganisms on the surface of the root system (bioceramic:soil = 3:7); V4R: microorganisms on the surface of the root system (Fe-C ceramic:soil = 3:7); V1L: microorganisms on the leaf surface (only soil); V2L: microorganisms on the leaf surface (sand:soil = 3:7); V3L: microorganisms on the leaf surface (bioceramic:soil = 3:7); V4L: microorganisms on the leaf surface (Fe-C ceramic:soil = 3:7)