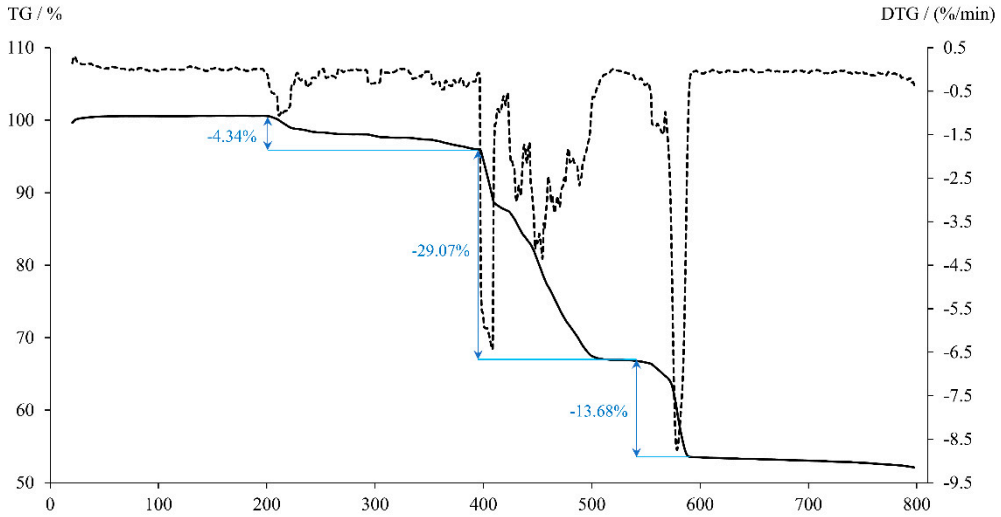


Figure S1. Thermogravimetric analysis of virgin polyethylene microplastic pellets.

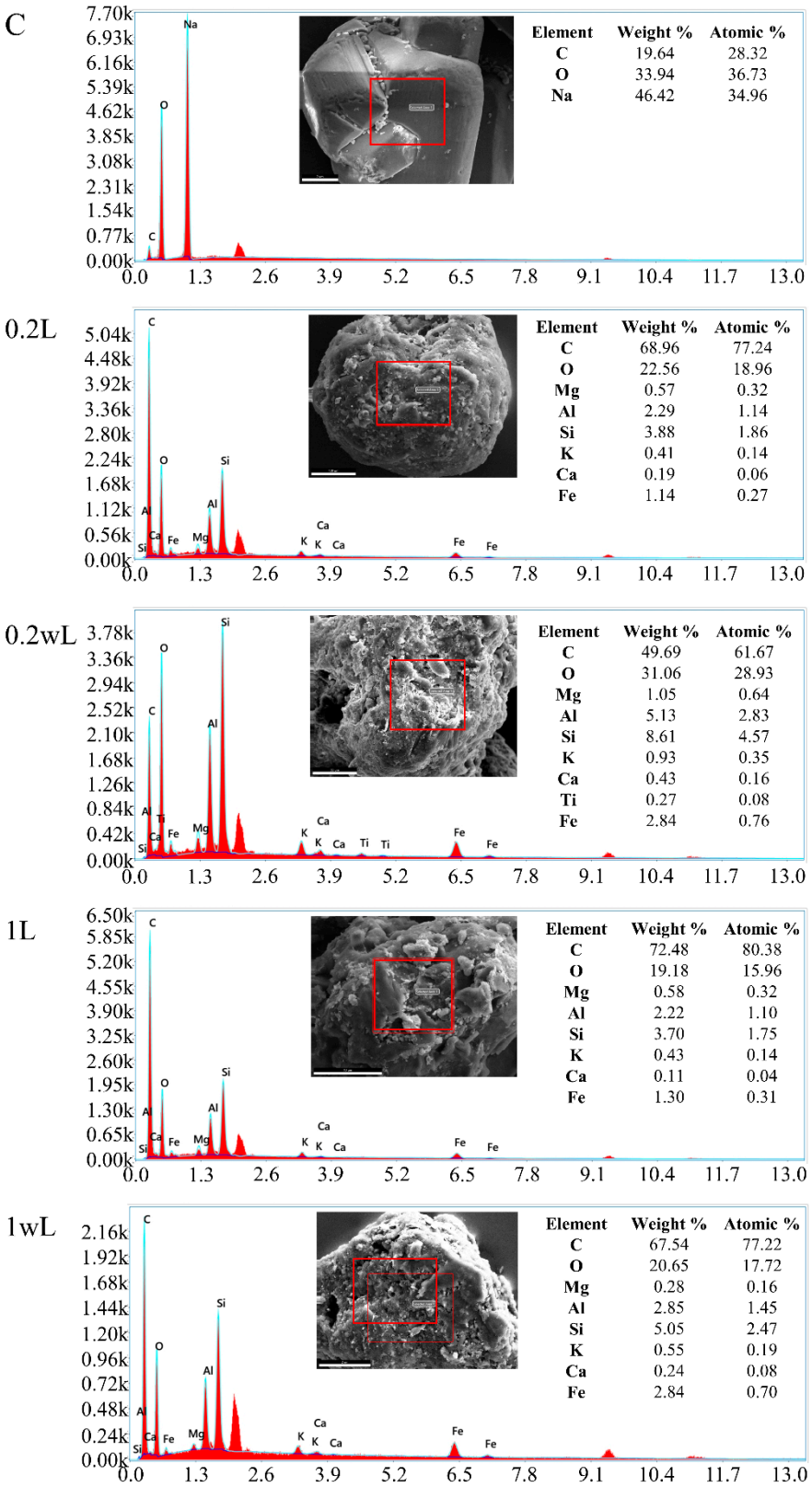
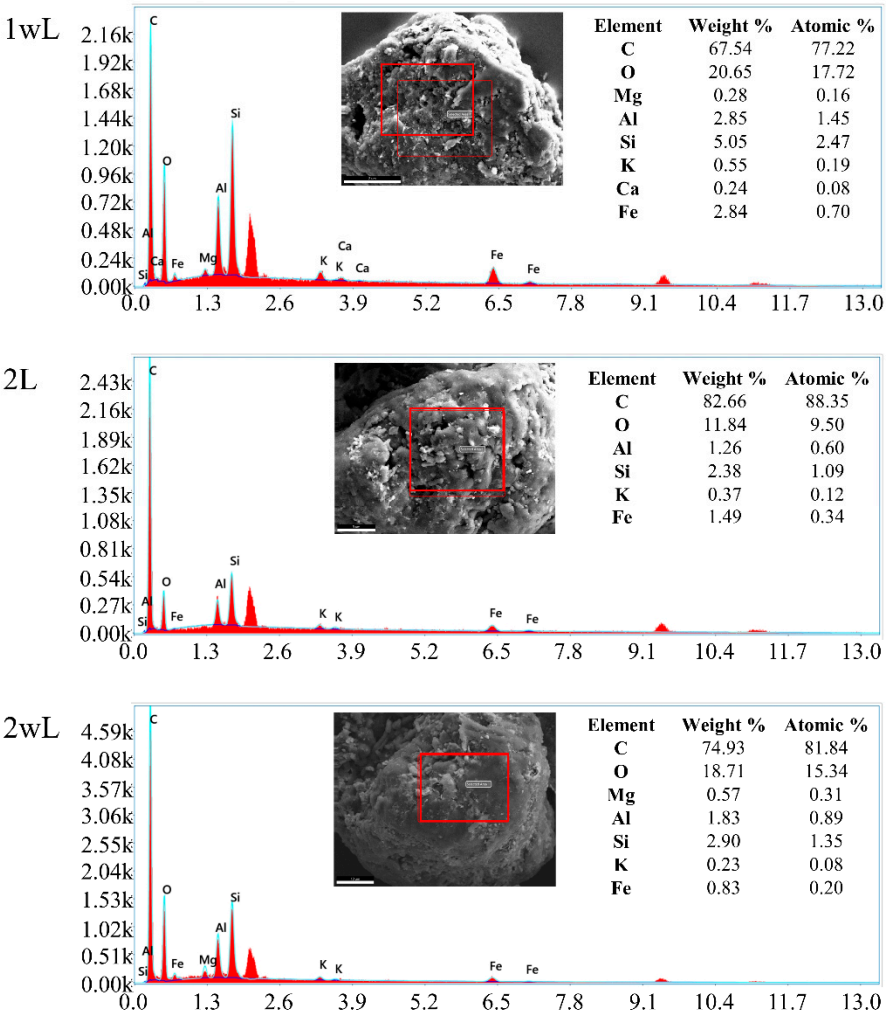


Figure S2. Energy dispersive spectrometer of the adsorption characteristics of soil elements on the surface of LDPE microplastic granules. Raw LDPE microplastic pellets (C), The red box indicated the area analyzed by energy dispersive spectrome-ter. The data in the figure represented the percentages of different elements on the surface of LDPE microplastic granules.



Continued from Figure S2 Energy dispersive spectrometer of the adsorption characteristics of soil elements on the surface of LDPE microplastic granules. Raw LDPE microplastic pellets (C), The red box indicated the area analyzed by energy dispersive spectrome-ter. The data in the figure represented the percentages of different elements on the surface of LDPE microplastic granules.

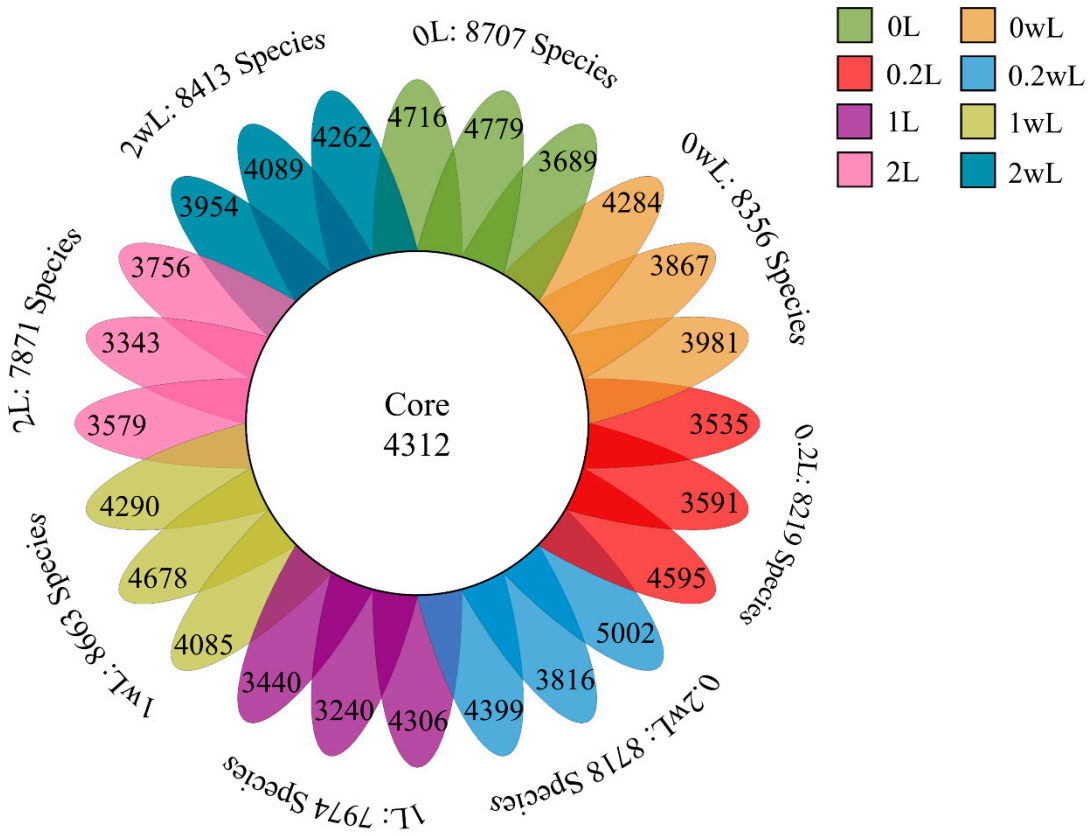


Figure S3. Venn diagram based on the level of soil bacterial species in the rhizosphere of the different treatment groups.

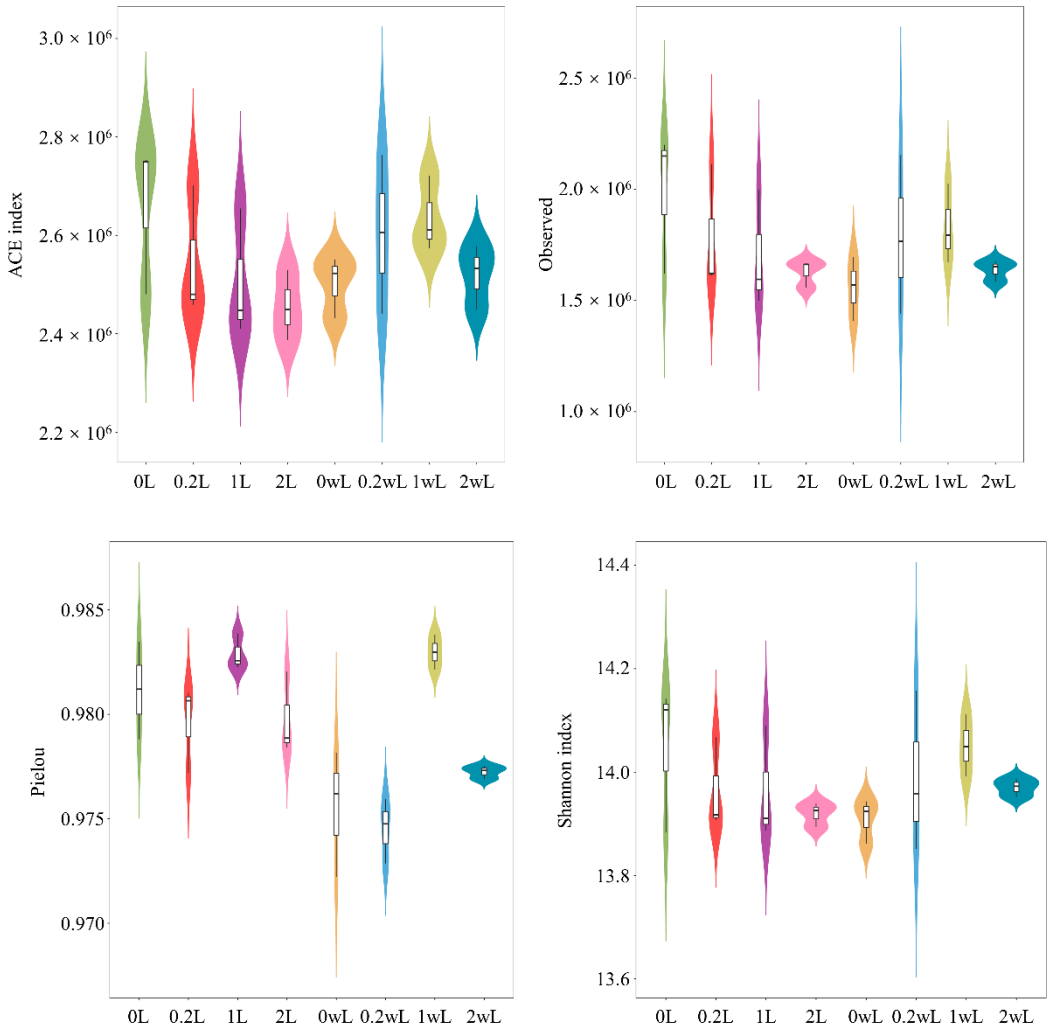


Figure S4. Analysis of the alpha diversity of the rhizosphere soil bacterial community in different treatment groups.

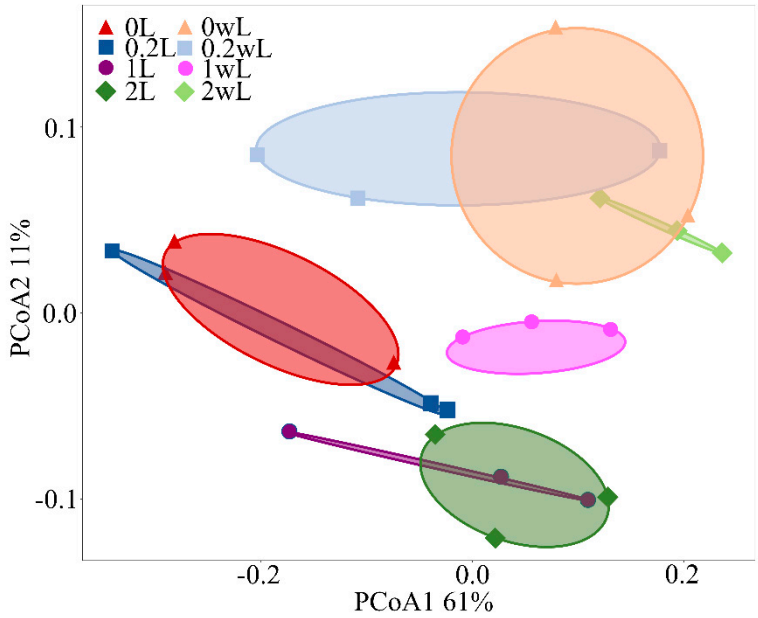


Figure S5. The β diversity of rhizosphere soil bacteria in the different treatment groups.

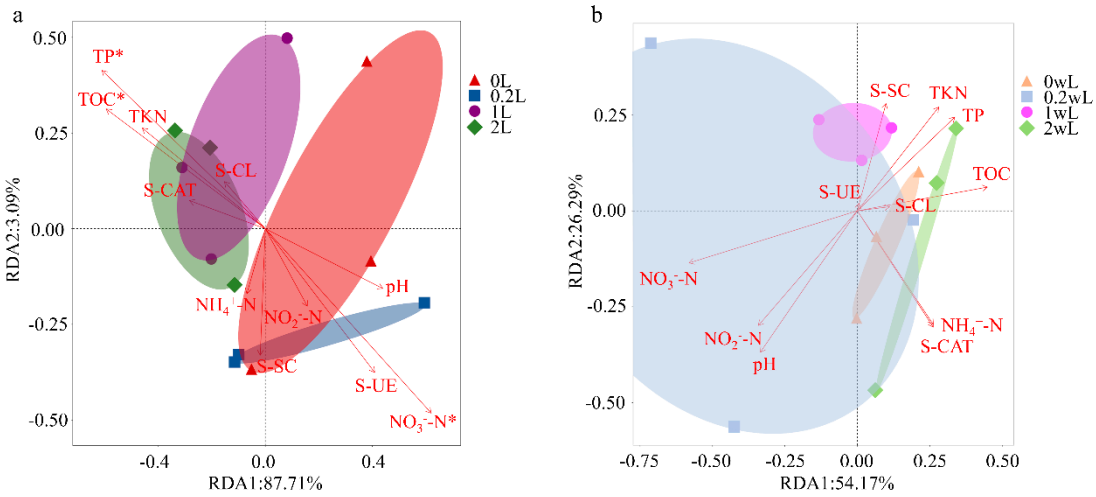


Figure S6. a and b indicate the response of rhizosphere soil bacteria to physicochemical parameters in the absence and presence of biomass additions, respectively. Note: catalase (S-CAT), urease (S-UE), cellulase (S-CL), and sucrase (S-SC). In Figure a, "*" indicate significant differences at the confidence levels of 0.05.

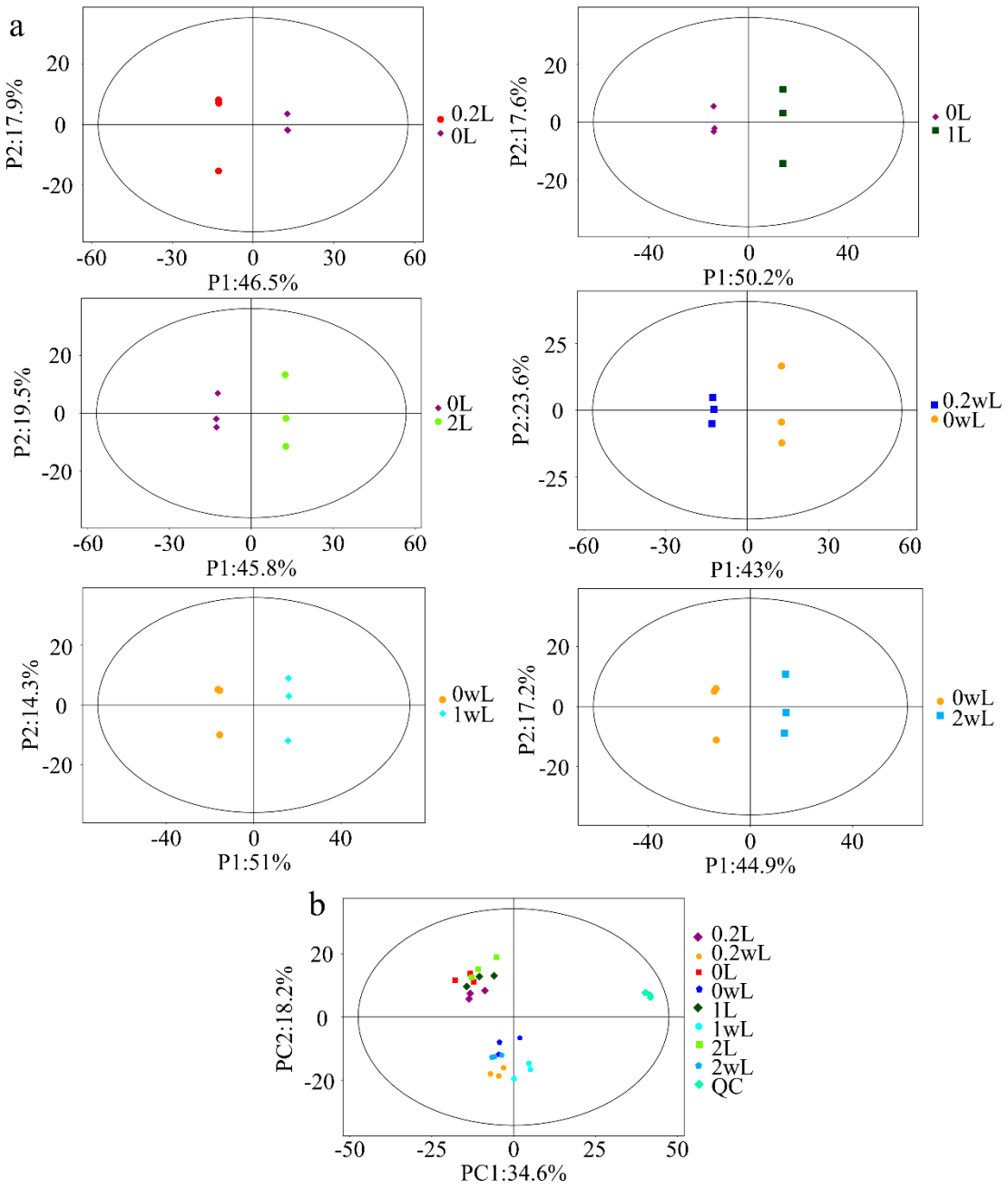


Figure S7. a shows the distribution of metabolites in different treatment groups through OPLS-DA model analysis. Figure b shows the distribution of differential metabolites in all treatment groups by principal component analysis, in which QC is quality control, and mutual clustering of QC indicates good quality control and reliable data.

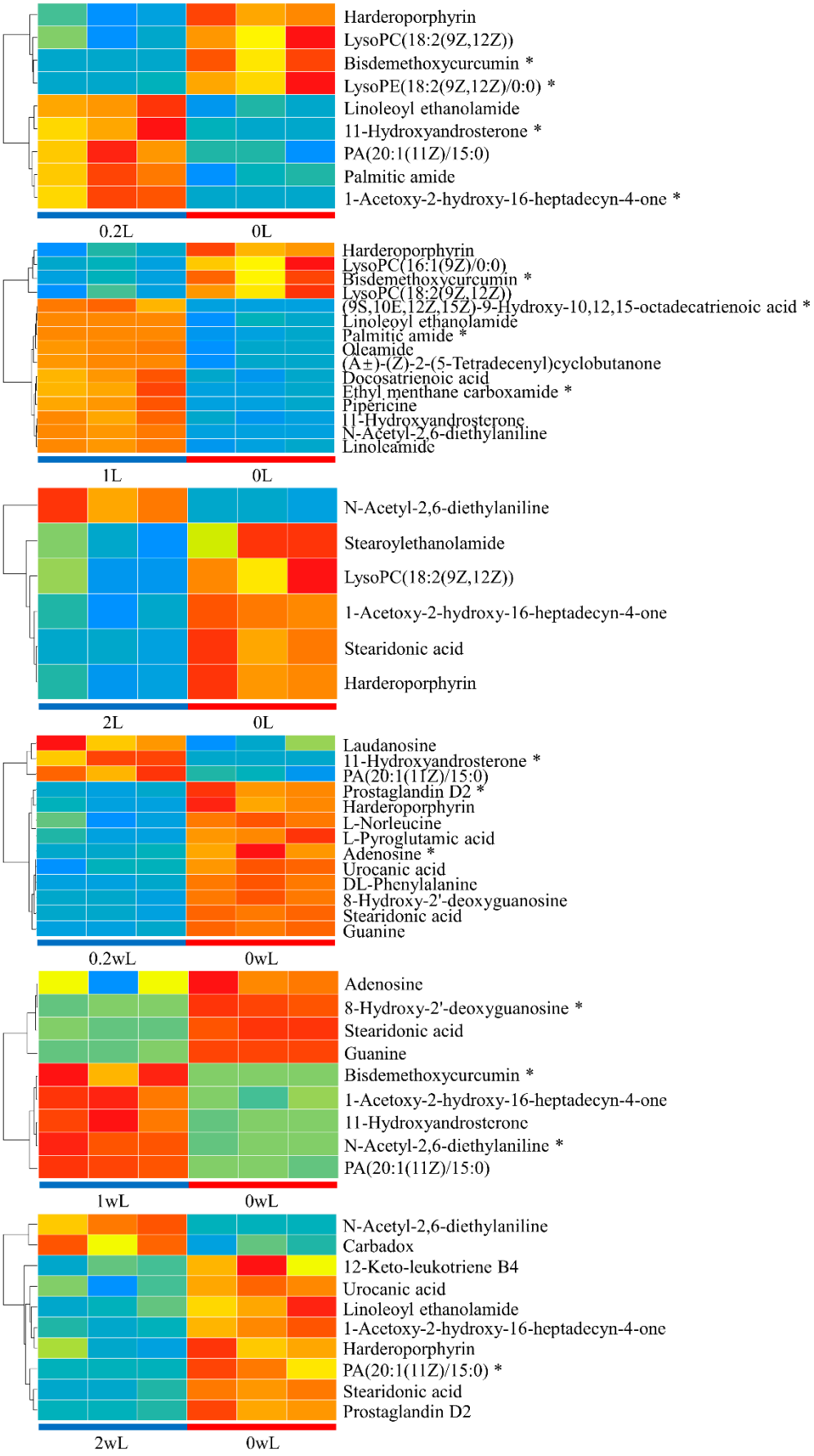


Figure S8. Differential metabolites in each treatment group, and "*" indicates that there is a significant difference at $P < 0.05$ level.

Table S1. Basic chemical properties of the test soils

TOC (g/kg)	NH_4^+-N (mg/kg)	NO_2^--N (mg/kg)	NO_3^--N (mg/kg)	TKN (mg/kg)	TP (mg/kg)	pH
10.10 ± 0.37	4.79 ± 1.09	0.06 ± 0.01	4.31 ± 0.73	118.18 ± 5.21	564.84 ± 8.98	7.96 ± 0.01

Table S2. Analysis on the difference of relative abundance of bacterial phylum in rhizosphere soil of each treatment group

Treatment	0L	0.2L	1L	2L	0wL	0.2wL	1wL	2wL
Proteobacteria	55.04±0.91bcde	50.79±2.63efg	49.79±1.79fg	47.49±2.89g	60.82±4.59a	59.3±2.79ab	52.84±1.05def	54.44±2.37cde
Acidobacteria	19.44±0.47bc	21.24±1.4abc	21.5±1.19abc	22.57±1.17a	16.95±1.73de	16.74±0.5e	21.16±1.16abc	19.34±1.91c
Candidatus_Rokubacteria	10.45±0.45b	11.21±0.81ab	11.84±0.28a	12.18±1.34a	6.52±1f	7.64±0.7ef	8.87±0.55cde	8.13±0.28de
Gemmatimonadetes	3.65±0.38g	4.03±0.16cdefg	4.18±0.14bcdefg	3.99±0.06defg	3.75±0.25fg	3.99±0.66efg	4.74±0.15abc	5.06±0.86a
Chloroflexi	3.18±0.16de	3.63±0.3abcd	4.06±0.09a	4.02±0.54a	2.48±0.48f	2.95±0.42ef	3.22±0.15cde	3.37±0.53bcde
Actinobacteria	2.3±0.17ab	2.3±0.31ab	2.08±0.33ab	1.84±0.07b	2.61±0.73ab	2.97±1.23a	2.54±0.3ab	2.48±0.72ab
Bacteroidetes	0.96±0.67b	1.24±0.7ab	1.29±0.63ab	1.84±0.04a	1.57±0.21ab	1.22±0.52ab	1.51±0.24ab	1.48±0.23ab
unclassified_Bacteria_phylum	1.16±0.02cd	1.26±0.09abc	1.24±0.08abc	1.32±0.02a	1.18±0.03bcd	1.12±0.08d	1.34±0.01a	1.3±0.13ab
Nitrospirae	1.02±0.16a	1.24±0.23a	1.07±0.16a	1.16±0.09a	1.09±0.03a	1.24±0.42a	1.03±0.03a	1.27±0.22a
Thaumarchaeota	0.66±0.63a	0.87±0.65a	0.74±0.46a	0.88±0.2a	1.12±0.33a	0.84±0.59a	0.65±0.32a	0.84±0.52a
Others	2.14±0.06efgh	2.2±0.08defgh	2.22±0.15cdefgh	2.71±0.22a	1.9±0.25h	1.98±0.34gh	2.09±0.08fgh	2.3±0.19bcdefg

Note: Different lowercase (a, b, c, d, e, f, g, h) letters indicated significant differences between different treatments ($P < 0.05$, n = 3).

Table S3. Analysis on the difference of relative abundance of bacterial genus in rhizosphere soil of each treatment group

Treatment	0L	0.2L	1L	2L	0wL	0.2wL	1wL	2wL
unclassified_Acidobacteria	13.13±0.19bc	14.07±0.58ab	14.19±0.46ab	14.57±0.71a	11.2±1.15e	11.27±0.14de	13.63±0.74abc	12.45±0.94cd
Sphingomonas	12.44±0.75a	10.66±0.5bc	12.16±0.2abc	11.02±0.7abc	12.06±2.44abc	11.43±0.61abc	10.65±0.25c	11.09±0.49abc
unclassified_Candidatus_Rokubacteria	10.45±0.45b	11.21±0.81ab	11.84±0.28a	12.18±1.34a	6.52±1f	7.64±0.7ef	8.87±0.55cde	8.13±0.28de
unclassified_Betaproteobacteria	7.21±0.18abc	7.59±0.42a	6.66±0.19abcde	6.54±0.68bcde	6.11±0.9de	6.72±0.83abcde	6.24±0.1cde	5.81±0.61e
unclassified_Deltaproteobacteria	5.1±0.2a	5.36±0.19a	4.97±0.3a	5.16±0.23a	3.82±0.69e	4.23±0.51bcde	4.12±0.21cde	3.88±0.19de
unclassified_Blastocatellia	3.56±0.3def	4.18±0.56bcd	4.41±0.48abc	4.98±0.47a	3.18±0.35ef	2.93±0.28f	4.5±0.3abc	4.08±0.67cd
unclassified_Chloroflexi	2.75±0.15cd	3.12±0.24abcd	3.59±0.06a	3.52±0.52a	2.09±0.43e	2.57±0.37de	2.78±0.15bcd	2.99±0.54abcd
unclassified_Gemmatimonadales	1.61±0.24g	1.69±0.17fg	1.87±0.08defg	1.79±0.08efg	1.96±0.25cdefg	2.07±0.42bcdefg	2.59±0.13a	2.79±0.56a
Massilia	2.33±0.91abcde	1.84±0.17abcde	1.57±0.13de	1.21±0.08e	3±0.81a	2.08±1.12abcde	1.73±0.62bcde	1.7±0.75cde
Bradyrhizobium	1.4±0.17def	1.11±0.18f	1.27±0.15ef	1.56±0.28cdef	2.91±1.19a	2.87±0.96a	1.78±0.13bcdef	2.24±0.7abcde
unclassified_Pyrinomonadaceae	1.8±0.2bc	2.09±0.32ab	2.04±0.25ab	2.2±0.08a	1.62±0.25cd	1.43±0.14d	2.09±0.15ab	1.83±0.24abc
Rhodospirillum	1.94±0.14b	1.55±0.24cde	1.5±0.07de	1.46±0.19e	2.11±0.18ab	2.2±0.07a	1.97±0.07ab	2.16±0.12ab
unclassified_Proteobacteria	1.93±0.04bcd	1.85±0.25cdef	1.53±0.16fg	1.37±0.3g	2.06±0.06abc	2.27±0.22a	1.66±0.11defg	1.55±0.23efg
unclassified_Gammaproteobacteria	1.52±0.1def	1.43±0.2efg	1.28±0.11fg	1.18±0.2g	1.79±0.06abc	1.98±0.05a	1.71±0.15bcd	1.63±0.24cde
unclassified_Myxococcaceae	1.61±0.2ab	1.66±0.16ab	1.81±0.09a	1.78±0.06a	1.09±0.08e	1.17±0.21de	1.51±0.06bc	1.31±0.18cde
Others	31.2±0.52cdef	30.61±0.44def	29.31±0.38f	29.49±1.23ef	38.47±1.91a	37.16±1.43a	34.17±1.23b	36.39±1.58a

Note: Different lowercase (a, b, c, d, e, f, g) letters indicated significant differences between different treatments ($P < 0.05$, n = 3).