|  |  |  |  |
| --- | --- | --- | --- |
| Indices | *df* | *F-*value | *P-*value |
| **Plant 13C and 15N abundance** |  |  |  |
| P-Atom13C | 3 | 2,344.800 | < 0.001 |
| P-Con13C | 3 | 10.552 | 0.004 |
| P-Atom15N | 3 | 69.870 | < 0.001 |
| P-Con15N | 3 | 693.370 | < 0.001 |
| **Soil 13C and 15N abundance** |  |  |  |
| S-Atom13C | 3 | 3.354 | 0.076 |
| S-Con13C | 3 | 3.400 | 0.074 |
| S-Atom15N | 3 | 278.170 | < 0.001 |
| S-Con15N | 3 | 106.320 | < 0.001 |
| **Soil enzymatic activity** |  |  |  |
| Urease activity | 3 | 1,824.800 | < 0.001 |
| Protease activity | 3 | 339.530 | < 0.001 |
| Glutaminase activity | 3 | 621.400 | < 0.001 |
| Catalase activity | 3 | 17.174 | < 0.001 |
| **alpha diversity index** |  |  |  |
| Shannon | 3 | 88.553 | < 0.001 |
| Simpson | 3 | 34.136 | < 0.001 |
| Chao1 | 3 | 16.999 | < 0.001 |
| Ace | 3 | 26.742 | < 0.001 |
| **bacterial phylum** |  |  |  |
| Proteobacteria | 3 | 8.036 | 0.008 |
| Acidobacteria | 3 | 2.830 | 0.106 |
| Verrucomicrobia | 3 | 4.094 | 0.049 |
| Actinobacteria | 3 | 5.320 | 0.026 |
| **bacterial genus** |  |  |  |
| *Rhodopseudomonas* | 3 | 14.735 | 0.001 |
| *Methylibium* | 3 | 14.087 | 0.001 |
| *Pseudomonas* | 3 | 7.877 | 0.009 |
| *Bradyrhizobium* | 3 | 19.648 | < 0.001 |

**Supplementary Table S1.** The results of a one-way ANOVA for plant 13C and 15N abundance, soil 13C and 15N abundance, soil enzymatic activity, alpha diversity index, bacterial phylum and bacterial genus.

Significance levels of one-way ANOVA: *P* < 0.01, highly significant; 0.01< *P* < 0.05, significant; *P* ≥ 0.05, not significant.

**Supplementary Table S2.** Effect of temperature and nitrogen application on significantly changed bacterial phyla in the rhizosphere soil.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Treatment | Proteobacteria | Acidobacteria | Verrucomicrobia | Actinobacteria |
| LN0 | 0.726 ± 0.0112a | 0.041 ± 0.0051b | 0.029 ± 0.0064b | 0.019 ± 0.0021ab |
| LN1 | 0.672 ± 0.0360b | 0.046 ± 0.0028ab | 0.032 ±0.0009b | 0.027 ± 0.0049a |
| RN0 | 0.621 ± 0.0061b | 0.061 ± 0.0140a | 0.040 ± 0.0166ab | 0.017 ± 0.0068b |
| RN1 | 0.672 ± 0.0195b | 0.043 ± 0.0011ab | 0.059 ± 0.0066a | 0.010 ± 0.0015b |

Note: Values were shown as means ± standard deviations (SD, n = 3). Different lowercase letters in the same column were indicated statistically significant differences between the four treatments at 0.05 level.

**Supplementary Table S3.** Pearson's correlation coefficients between dominant bacterial phyla and 13C and 15N abundance.

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | P-Atom13C | P-Con13C | P-Atom15N | P-Con15N | S-Atom13C | S-Con13C | S-Atom15N | S-Con15N |
| Proteobacteria | -0.018  | -0.265  | -0.073  | -0.004  | -0.133  | 0.098  | -0.057  | -0.063  |
| Bacteroidetes | 0.014  | -0.106  | -0.049  | -0.118  | -0.025  | -0.528  | 0.212  | 0.249  |
| Acidobacteria | -0.312  | 0.087  | -0.292  | -0.321  | 0.024  | -0.125  | -0.224  | -0.228  |
| Verrucomicrobia | 0.421  | 0.587\* | 0.597\* | 0.621\* | 0.743\*\* | 0.398  | 0.056  | 0.029  |
| Firmicutes | 0.588\* | 0.524  | 0.591\* | 0.586\* | 0.365  | 0.525  | 0.419  | 0.370  |
| Actinobacteria | 0.002  | -0.474  | -0.194  | -0.313  | -0.429  | -0.189  | 0.443  | 0.440  |
| Fibrobacteres | 0.034  | 0.012  | 0.255  | 0.193  | 0.446  | -0.140  | -0.067  | -0.072  |
| Gemmatimonadetes | -0.210  | 0.222  | -0.171  | -0.144  | -0.266  | 0.295  | -0.259  | -0.249  |
| Chloroflexi | -0.279  | 0.250  | -0.178  | -0.171  | -0.236  | 0.262  | -0.355  | -0.357  |

Significance levels of one-way ANOVA: \*, 0.01 < *P* < 0.05, significant; \*\*, *P* < 0.01, highly significant; ns, *P* ≥ 0.05, not significant.

**Supplementary Table S4.** Pearson's correlation coefficients between significantly changed bacterial genera and 13C and 15N abundance.

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | P-Atom13C | P-Con13C | P-Atom15N | P-Con15N | S-Atom13C | S-Con13C | S-Atom15N | S-Con15N |
| *Asticcacaulis* | -0.176  | -0.131  | -0.082  | 0.007  | -0.123  | -0.113  | -0.383  | -0.373  |
| *Devosia* | 0.147  | 0.320  | 0.394  | 0.452  | 0.475  | 0.184  | -0.244  | -0.256  |
| *Rhizobacter* | -0.003  | -0.567  | -0.189  | -0.264  | -0.057  | -0.188  | 0.349  | 0.337  |
| *Ferruginibacter* | 0.245  | -0.180  | 0.107  | 0.037  | 0.144  | -0.322  | 0.519  | 0.541  |
| *Emticicia* | 0.335  | 0.547  | 0.345  | 0.470  | 0.448  | 0.254  | 0.097  | 0.151  |
| *Lacunisphaera* | 0.533  | 0.575  | 0.707\* | 0.716\*\* | 0.800\*\* | 0.392  | 0.189  | 0.180  |
| *Pseudolabrys* | 0.246  | 0.364  | 0.394  | 0.463  | 0.574  | 0.063  | -0.059  | -0.038  |
| *Mesorhizobium* | -0.103  | -0.595\* | -0.213  | -0.255  | -0.366  | -0.246  | 0.153  | 0.156  |
| *Phenylobacterium* | 0.325  | 0.290  | 0.376  | 0.411  | 0.351  | 0.261  | 0.190  | 0.190  |
| *Dokdonella* | 0.446  | 0.266  | 0.492  | 0.536  | 0.164  | 0.647\* | 0.251  | 0.241  |
| *Candidatus\_Solibacter* | -0.304  | -0.107  | -0.323  | -0.330  | 0.126  | -0.403  | -0.199  | -0.212  |
| *unidentified\_Acidobacteria* | -0.112  | 0.065  | -0.030  | -0.101  | 0.352  | -0.240  | -0.035  | -0.036  |
| *Caulobacter* | 0.635\* | 0.081  | 0.583\* | 0.543  | 0.364  | 0.299  | 0.593\* | 0.604\* |
| *Rhodanobacter* | -0.151  | -0.294  | -0.264  | -0.358  | -0.376  | 0.174  | 0.140  | 0.108  |
| *unidentified\_Gammaproteobacteria* | -0.442  | 0.017  | -0.388  | -0.325  | -0.488  | -0.079  | -0.560  | -0.594  |
| *Rhodopseudomonas* | 0.813\*\* | 0.837\*\* | 0.851\*\* | 0.901\*\* | 0.682\* | 0.683\* | 0.463  | 0.440  |
| *Methylibium* | 0.789\*\* | 0.794\*\* | 0.846\*\* | 0.886\*\* | 0.684\* | 0.632\* | 0.435  | 0.412  |
| *Pseudomonas* | 0.685\* | 0.699\* | 0.828\*\* | 0.852\*\* | 0.715\*\* | 0.594\* | 0.358  | 0.385  |
| *Bradyrhizobium* | 0.863\*\* | 0.782\*\* | 0.896\*\* | 0.911\*\* | 0.749\*\* | 0.674\* | 0.557  | 0.526  |

Significance levels of one-way ANOVA: \*, 0.01 < *P* < 0.05, significant; \*\*, *P* < 0.01, highly significant; ns, *P* ≥ 0.05, not significant.

**Supplementary Table S5.** Pearson's correlation coefficients between 13C and 15N abundance and 13C and 15N abundance.

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | P-Atom13C | P-Con13C | P-Atom15N | P-Con15N | S-Atom13C | S-Con13C | S-Atom15N | S-Con15N |
| P-Atom13C | 1 | 0.593\* | 0.927\*\* | 0.906\*\* | 0.685\* | 0.622\* | 0.853\*\* | 0.844\*\* |
| P-Con13C | 0.593\* | 1 | 0.632\* | 0.727\*\* | 0.605\* | 0.676\* | 0.202 | 0.199 |
| P-Atom15N | 0.927\*\* | 0.632\* | 1 | 0.978\*\* | 0.711\*\* | 0.713\*\* | 0.655\* | 0.643\* |
| P-Con15N | 0.906\*\* | 0.727\*\* | 0.978\*\* | 1 | 0.736\*\* | 0.736\*\* | 0.567 | 0.561 |
| S-Atom13C | 0.685\* | 0.605\* | 0.711\*\* | 0.736\*\* | 1 | 0.488 | 0.461 | 0.468 |
| S-Con13C | 0.622\* | 0.676\* | 0.713\*\* | 0.736\*\* | 0.488 | 1 | 0.306 | 0.274 |
| S-Atom15N | 0.853\*\* | 0.202 | 0.655\* | 0.567 | 0.461 | 0.306 | 1 | 0.995\*\* |
| S-Con15N | 0.844\*\* | 0.199 | 0.643\* | 0.561 | 0.468 | 0.274 | 0.995\*\* | 1 |

Significance levels of one-way ANOVA: \*, 0.01 < *P* < 0.05, significant; \*\*, *P* < 0.01, highly significant; ns, *P* ≥ 0.05, not significant.