

Table S1 The QA/QC information for all measurements and analyzers used.

Measured factors	Quality control/analysis
Enzyme activity	4-methylumbelliferone
Total phosphorus	Molybdenum blue
Dissolved organic carbon	Sodium carbonate solution

Table S2 The abbreviations of types, substrates, and functions of soil extracellular enzymes.

Extracellular enzyme	Abbreviation	Substrate	Function
β -1,4-glucosidase	BG	4-MUB- β -D-glucoside	Releases glucose from cellulose
β -1,4-xylosidase	XYL	4-MUB- β -D- xyloside	Releases xylose from hemicellulose
Cellobiohydrolase	CBH	4-MUB- β -D-cellobioside	Releases disaccharides from cellulose
β -1,4-N-acetylglucosaminidase	NAG	4-MUB-N-acetyl- β -D-glucosaminide	Releases N-acetyl glucosamine from oligosaccharides
L-leucine aminopeptidase	LAP	L-leucine-7-amido-4-methylcoumarin	Releases methylcoumarin from chitin

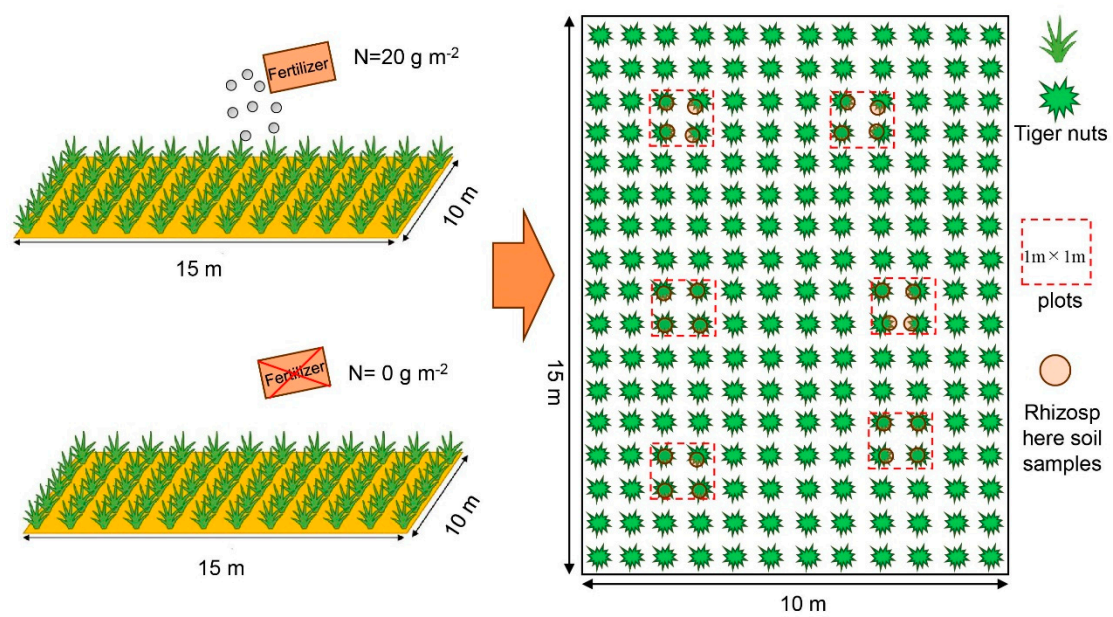


Figure S1 Two different fertilization treatments and sampling methods in study area.

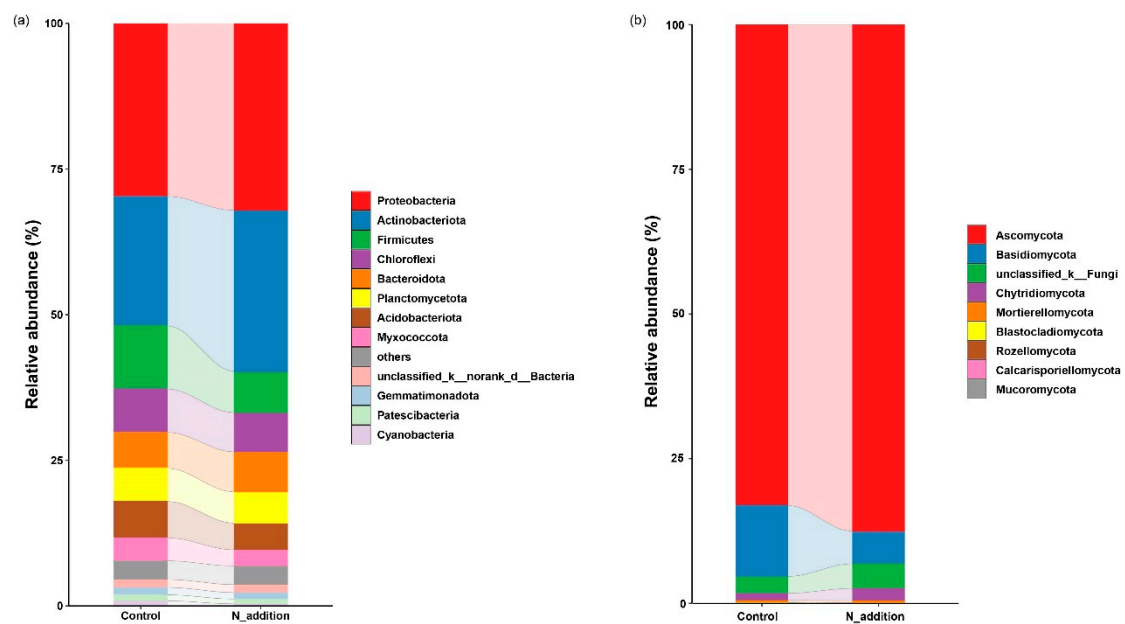


Figure S2 Rhizosphere microbial community composition of bacteria (a) and fungal (b) at the phylum level under N addition.

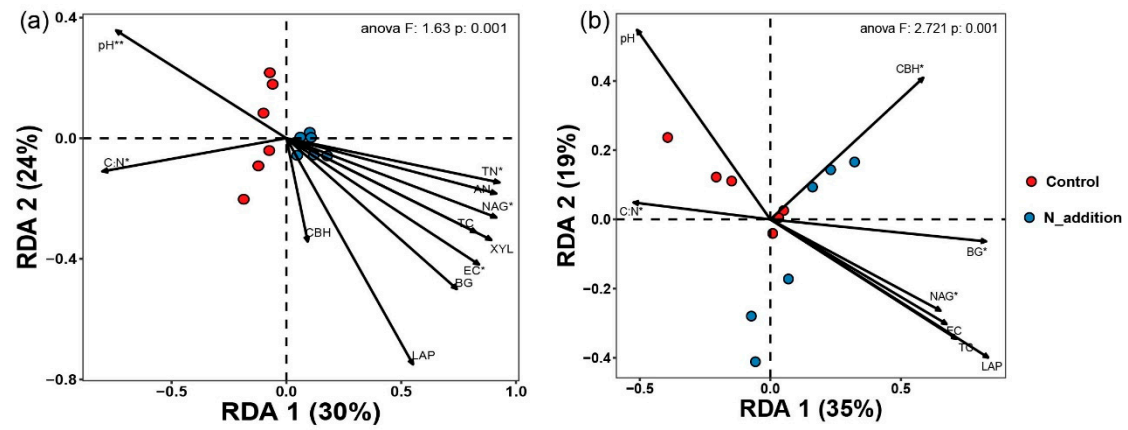


Figure S3 Redundancy analysis of environmental factors and rhizosphere bacterial (a) and fungal (b) microbial communities. The asterisks represent the significance ($p < 0.05$) factor via forward selection.

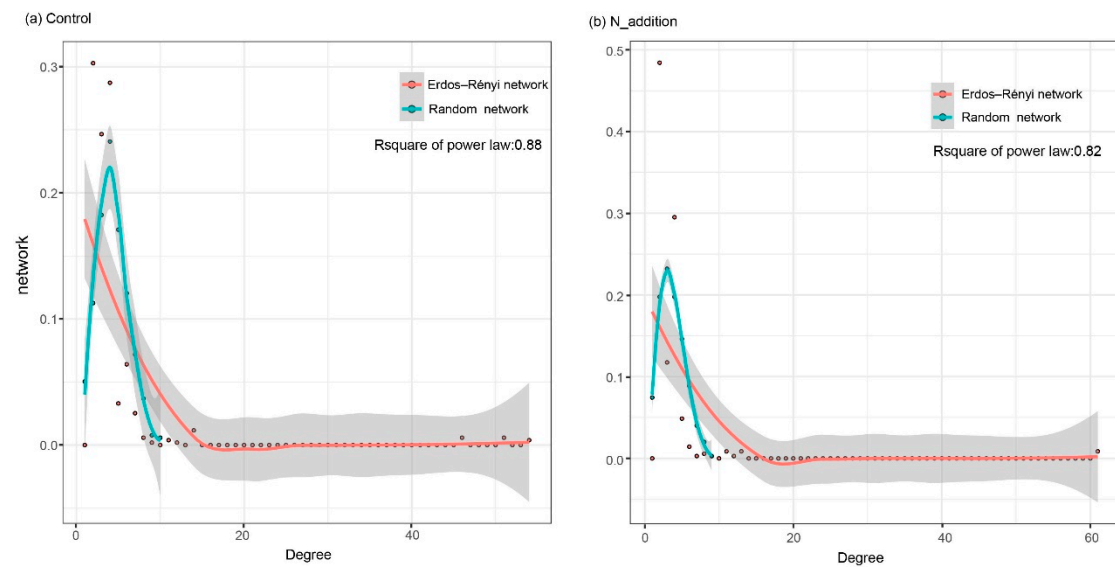


Figure S4 Network topological feature of degree distribution pattern of rhizosphere microbial.

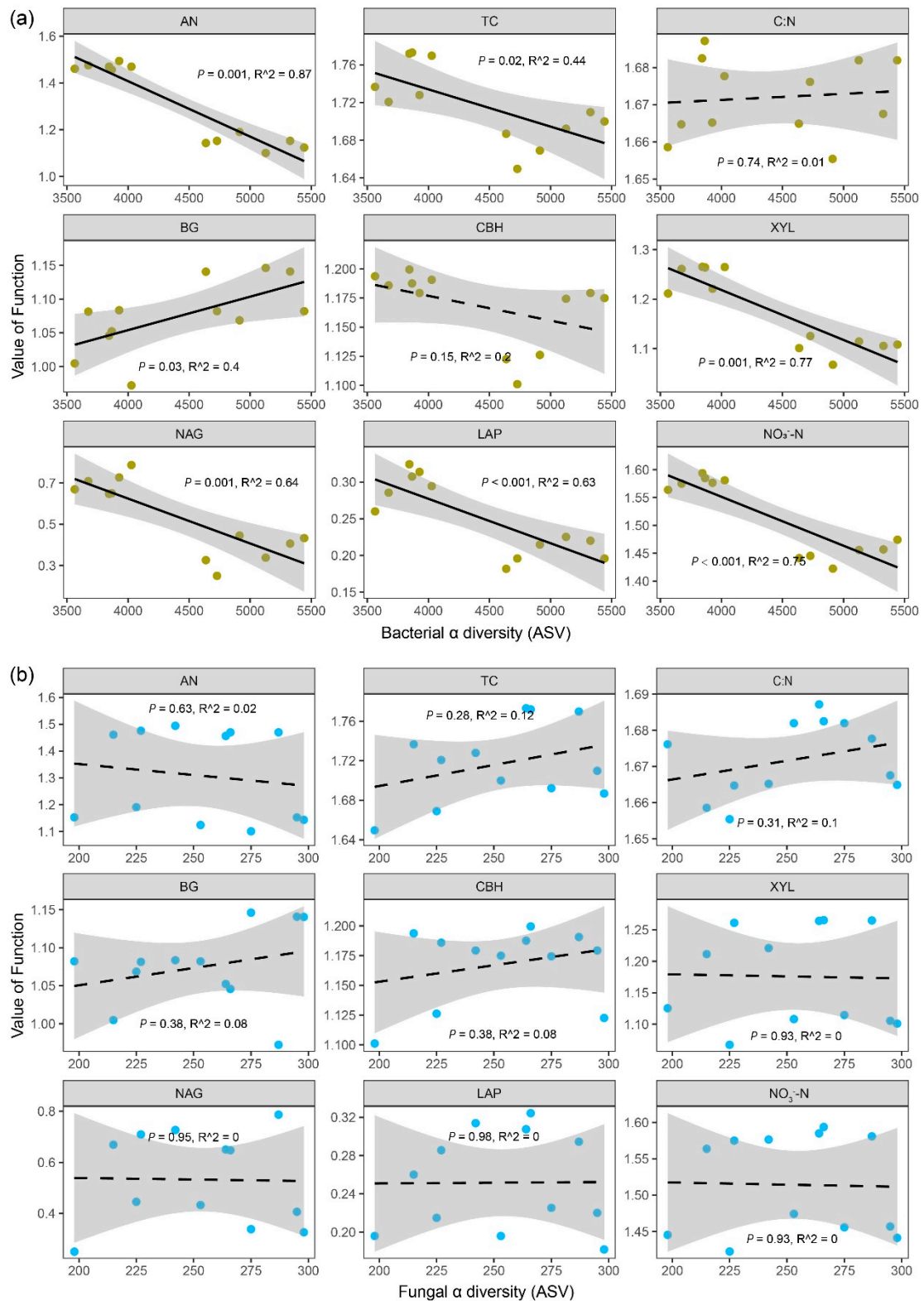


Figure S5 Relationships between rhizosphere soil bacterial (a) and fungal (b) α diversity and individual soil function (N = 12). Solid and dashed lines denote statistically significant (two-sided $p < 0.05$) and nonsignificant (two-sided $p > 0.05$) relationships, respectively. The shaded areas show the 95% confidence interval of the fit. AN, TC, C: N, BG, CBH, XYL, NAG, LAP, NO₃-N and MBP were log transformed.

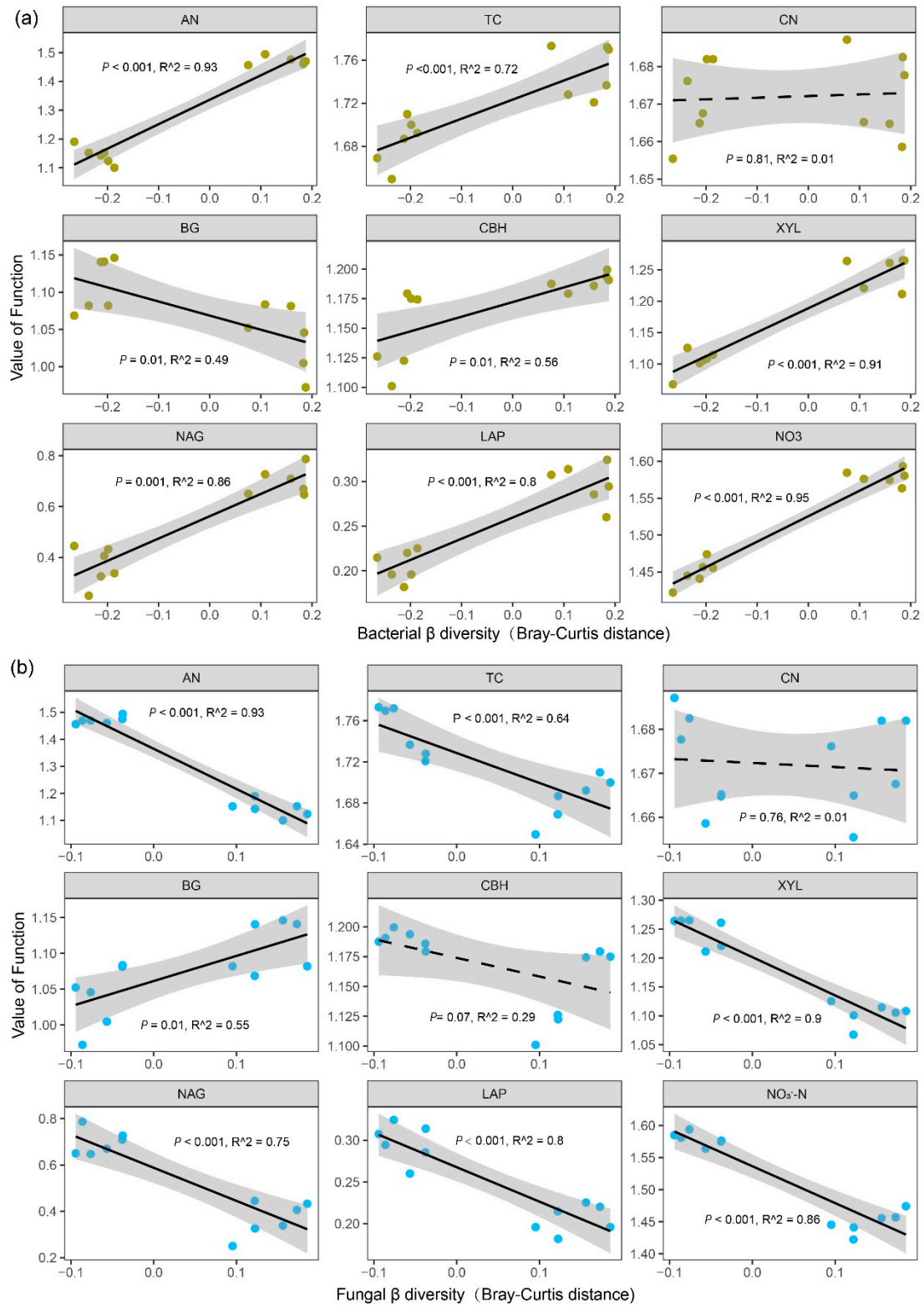


Figure S6 Relationships between rhizosphere soil bacterial (a) and fungal (b) β diversity and individual soil function (N = 12). Solid and dashed lines denote statistically significant (two-sided $p < 0.05$) and nonsignificant (two-sided $p > 0.05$) relationships, respectively. The shaded areas show the 95% confidence interval of the fit. AN, TC, C:N, BG, CBH, XYL, NAG, LAP, NO₃-N and MBP were log transformed.