

Table S1. The treatments and the number of replicates in this experiment.

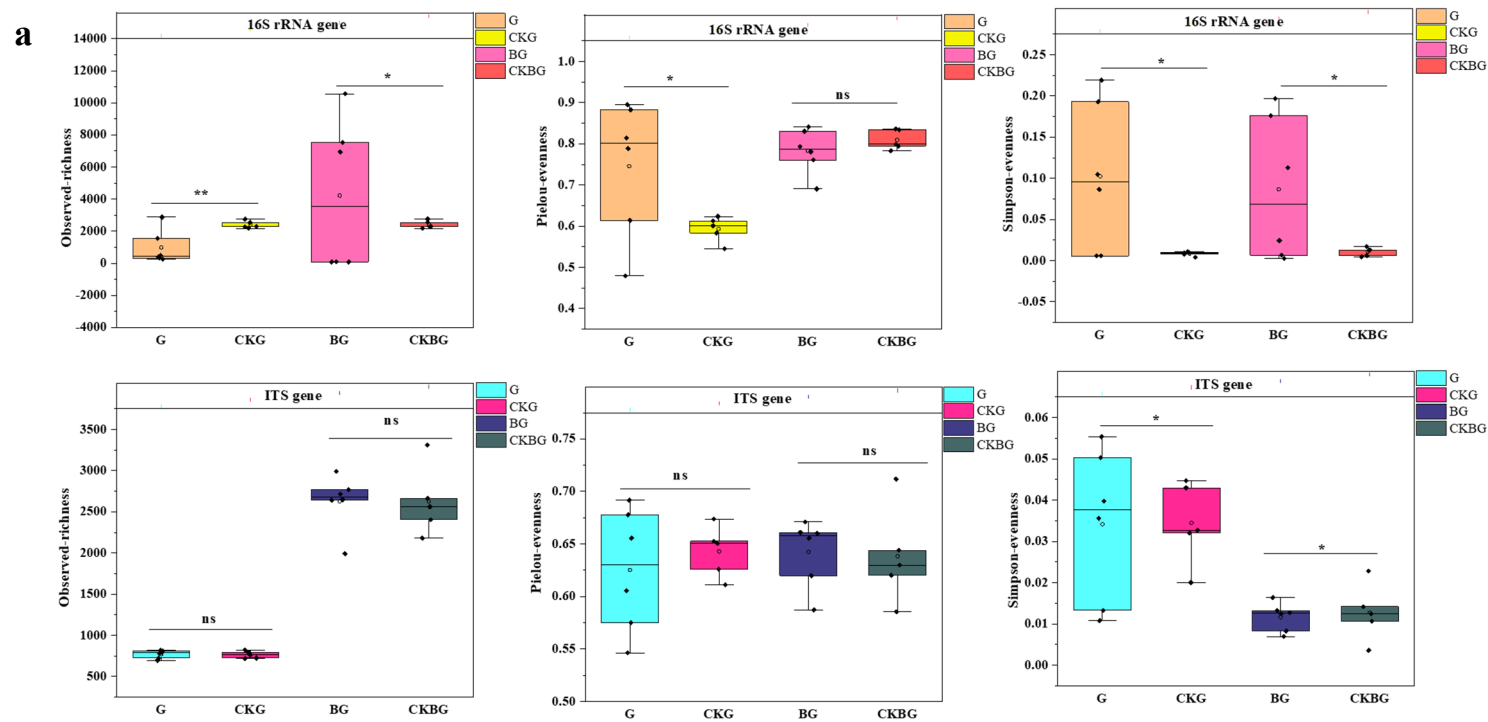
Planting pattern	Soil type	Sample designation	Forage species	# of replicates
Monoculture	Rhizosphere soil	G	Aba	6
		CKG	Aba	5
		MG	Chuancao+Aba	9
		CKMG	Chuancao+Aba	9
		ML	Beilin 201	10
Grass-legume mixture		CKML	Beilin 201	11
		BG	Aba	6
		CKBG	Aba	5
Grass-legume mixture	Bulk soil	BF	Chuancao+Aba+ Beilin 201	12
		BCK	Chuancao+Aba+ Beilin 201	12

Table S2. Physicochemical properties and forage biomass of soils from grass-legume mixtures under organic fertilization and non-fertilized. Under the grass-legume mixtures, MG: rhizosphere samples of grass OF; CKMG: rhizosphere samples of grass non-OF; ML: rhizosphere samples of legume OF; CKML: rhizosphere samples of legume non-OF; BF: bulk soils samples of OF; BCK: bulk soil samples of non-OF.

Soil properties	Soil sample in different group					
	MG	CKMG	ML	CKML	BF	BCK
TN (mg·kg <sup>-1</sup> )	1732.98±188.30a	1632.78±97.66a	1810.96±214.37a	1666.92±139.21a	1802.82±206.01a	1647.39±135.72ab
NO <sub>3</sub> -N (mg·kg <sup>-1</sup> )	40.85±3.19a	39.85±2.68a	40.28±2.24a	39.47±2.24a	40.75±2.84a	39.75±2.30a
NH <sub>4</sub> -N (mg·kg <sup>-1</sup> )	4.35±0.71a	4.25±0.75a	4.44±0.77a	4.32±0.83a	4.47±0.84a	4.40±0.74a
TOC (%)	2.20±0.26a	1.84±0.29a	2.26±0.28a	2.03±0.27a	2.27±0.27a	1.94±0.31ab

Different letters in columns indicate significant differences ( $P < 0.05$ ).

Figure S1 Diversity of microbial communities in the OF and non-OF bulk soil and rhizosphere soil based on 16S rRNA gene and ITS gene sequencing. (a) Monoculture; (b) Grass-legume mixtures. \* indicates significant differences ( $P < 0.05$ ). Under the monoculture: G: rhizosphere samples of OF; CKG: rhizosphere samples of non-OF; BG: bulk soil samples of OF; CKBG: bulk soil samples of non-OF. Under the grass-legume mixture: MG: rhizosphere samples of grass OF; CKMG: rhizosphere samples of grass non-OF; ML: rhizosphere samples of legume OF; CKML: rhizosphere samples of legume non-OF; BF: bulk soils samples of OF; BCK: bulk soil samples of non-OF.



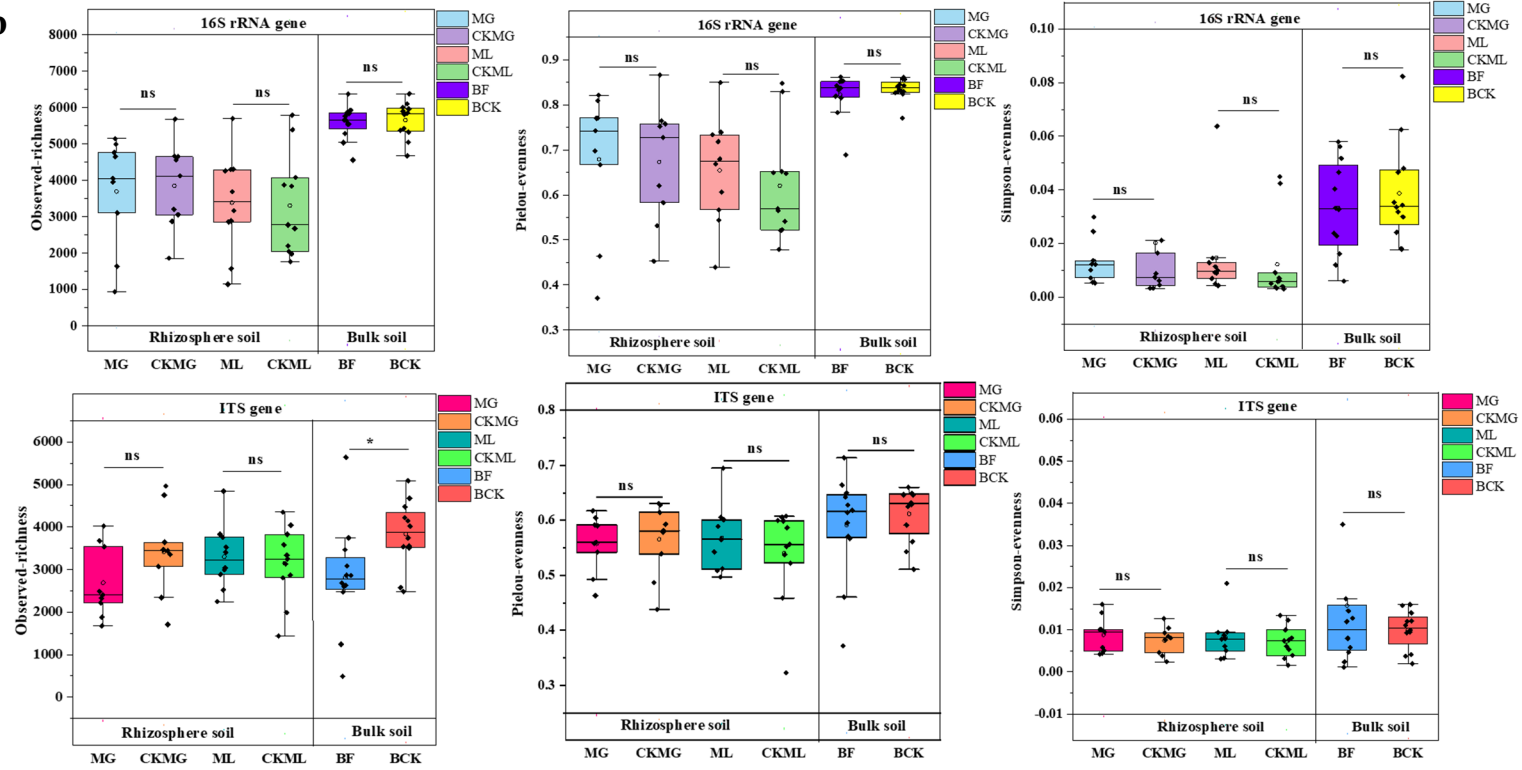
**b**

Figure S2 NMDS plot of rhizosphere and bulk soil microbial communities in organic fertilization and non-fertilization under grass-legume mixtures. Note: MG: black squares represent grass rhizosphere OF; CKMG: green circle represents non-OF in the rhizosphere of Grass; ML: pink triangle represents legume rhizosphere OF; CKML: blue pentagram represents the legume rhizosphere non-OF; BF: yellow diamonds represent bulk soil fertilization; BCK: blue triangle represents bulk soil non-fertilization.

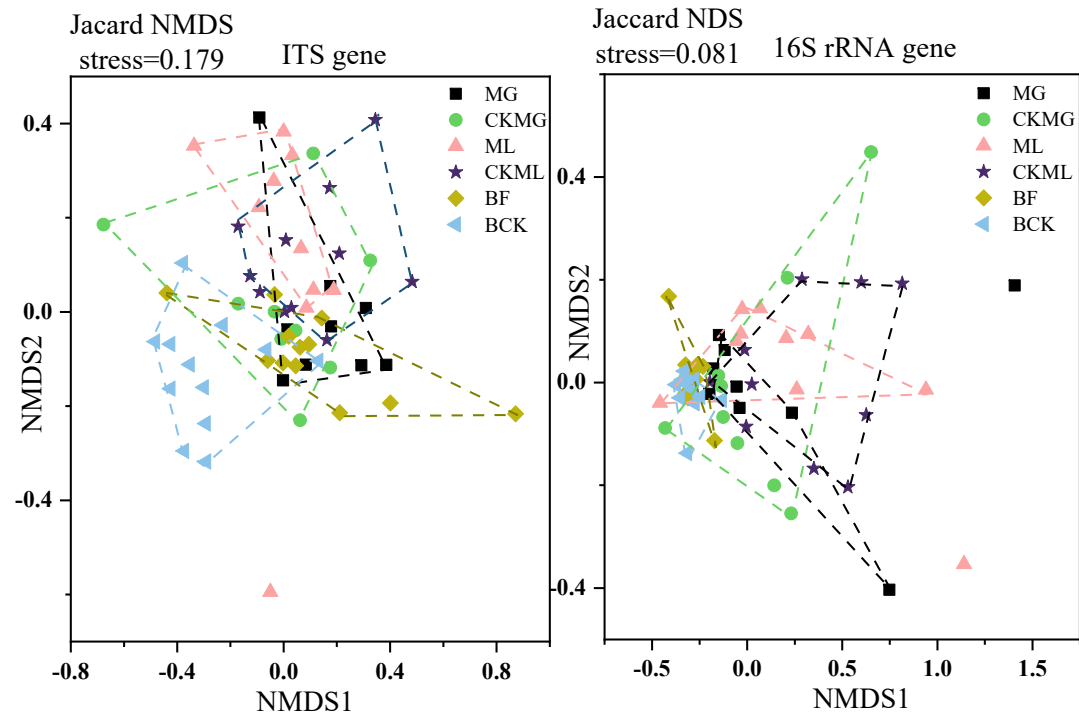


Figure S3. Microbial composition of rhizosphere and bulk soils under grass-legume mixtures. (a) Fungi, (b) Prokaryotic. MG: rhizosphere samples of grass OF; CKMG: rhizosphere samples of grass non-OF; ML: rhizosphere samples of legume OF; CKML: rhizosphere samples of legume non-OF; BF: bulk soils samples of OF; BCK: bulk soil samples of non-OF.

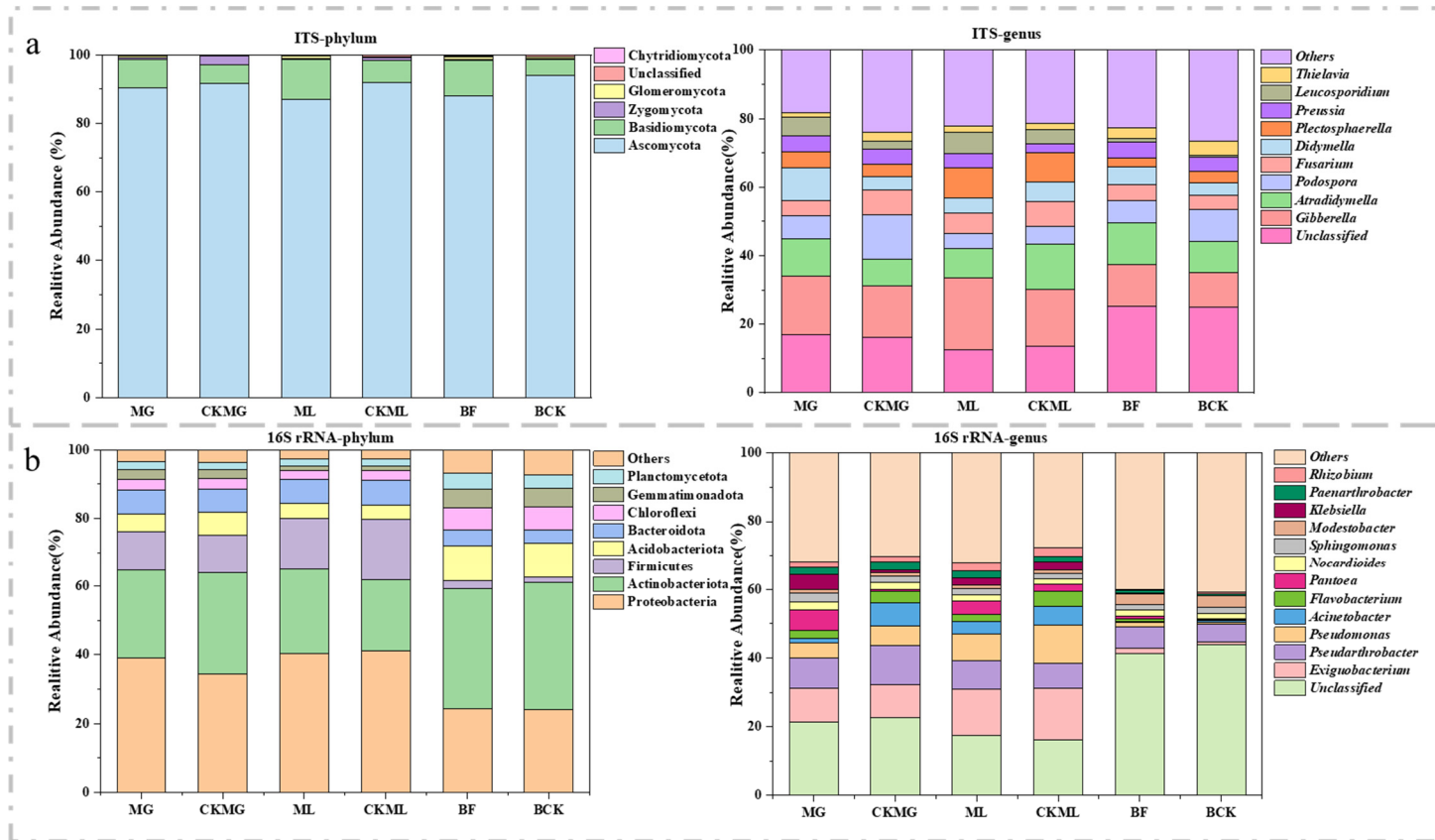


Figure S4. Histogram of LDA SCORE (log 10) distribution. (a) Comparison of Grass (MG) and legume (ML) in rhizosphere fungal communities. (b) Comparison of bulk soil (BCK V.S. BF) for bacterial and fungal communities.

