Improvement of Saline Soil Properties and *Brassica rapa* L. Growth Using Biofertilizers

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Supplementary Materials:

Table S1 Properties of saline-alkali soil and organic fertilizers

Soil sample		Organic fertilizer	
Soil Total Soluble Salt (TSS) ($g·kg^{-1}$)	8.8±0.21	Organic Matter (OM) ($g·kg^{-1}$)	400±24
pH	8.65±0.56	Total Nitrogen (TN) ($g·kg^{-1}$)	18.0±1.17
Soil Organic Matter (SOM) ($g·kg^{-1}$)	14.7±1.21	P_2O_5 ($g·kg^{-1}$)	11.1±0.21
Available Phosphorus (AP) ($mg·kg^{-1}$)	9.9±0.87	K_2O ($g·kg^{-1}$)	5.8±0.11
Available Potassium (AK) ($mg·kg^{-1}$)	440±47	Total Soluble Salt (TSS) ($g·kg^{-1}$)	4.0±0.12
Total Nitrogen (TN) ($mg·kg^{-1}$)	613±55	Electric Conductivity (EC) ($mS·cm^{-1}$)	1.2±0.08
Total Carbon (TC) ($g·kg^{-1}$)	21.3±1.26	pH	7.45±0.13
Carbon-Nitrogen ratio (C/N ratio)	33.3±1.58	Zn ($mg·kg^{-1}$)	45.08±2.13
		Cu ($mg·kg^{-1}$)	6.34±0.13

Density (g/cm^3)	8.46±0.10

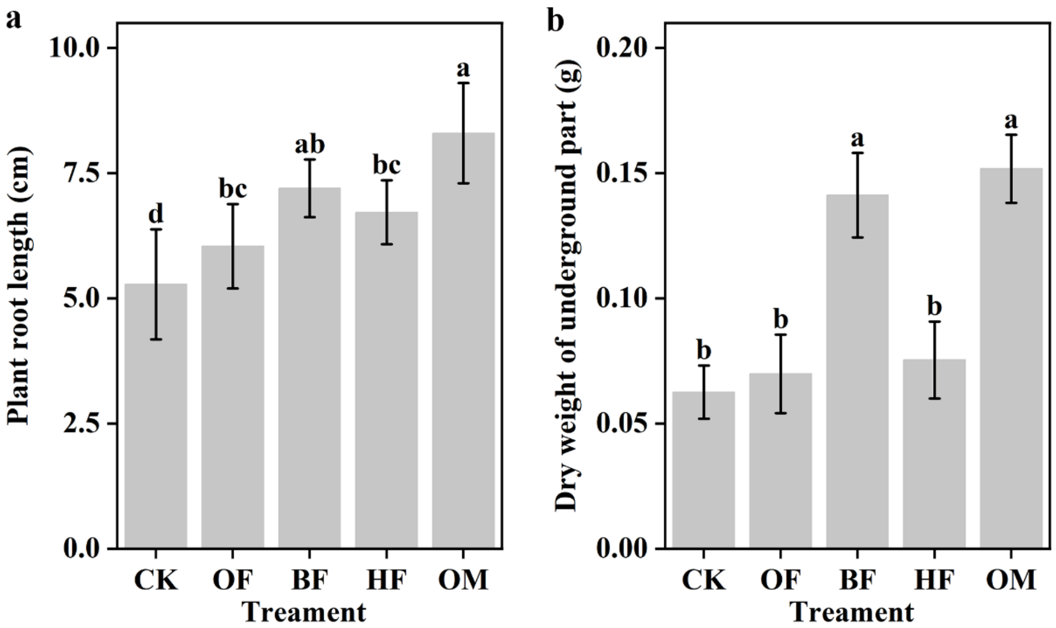


Figure S1. Plant root length (a) and dry weight of underground part (b) of plant. CK, control; OF, organic fertilizer; BF, organic fertilizer with *B. licheniformis*; HF, organic fertilizer with *H. profundi*. OM organic fertilizer with *B. licheniformis* and *H. profundi*. P-values were analyzed using one-way ANOVA and Student's t-test ($p < 0.05$).

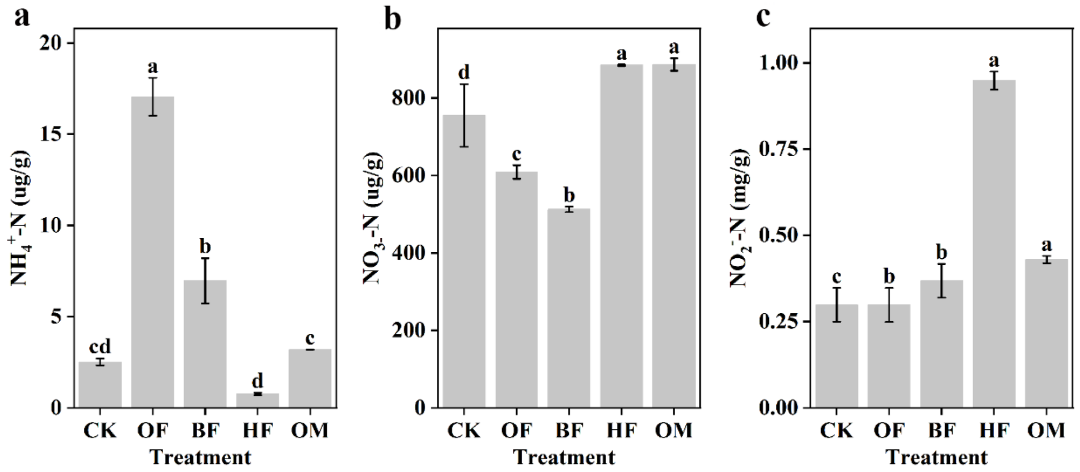


Figure S1. The content of NH_4^+-N (a), NO_3^--N (b), NO_2^--N (c) in the saline-alkali soil. CK, control; OF, organic fertilizer; BF, organic fertilizer with *B. licheniformis*; HF, organic fertilizer with *H. profundi*. OM organic fertilizer with *B. licheniformis* and *H. profundi*. P-values were analyzed using one-way ANOVA and Student's t-test ($p < 0.05$).

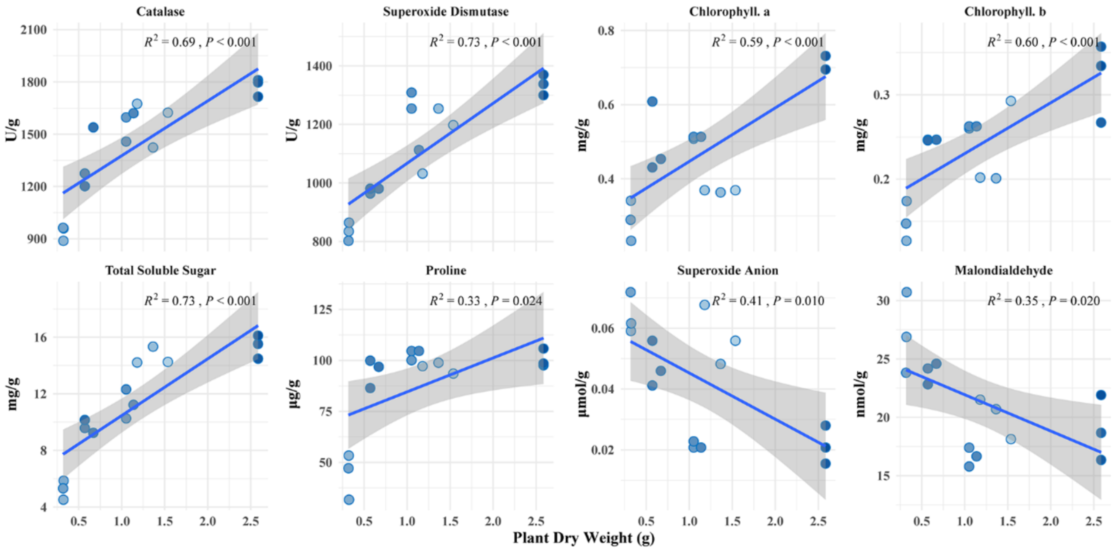


Figure S3. Linear regression relationship between the levels of different plant physiological indexes and the amount of dry weight of plant above-ground parts.

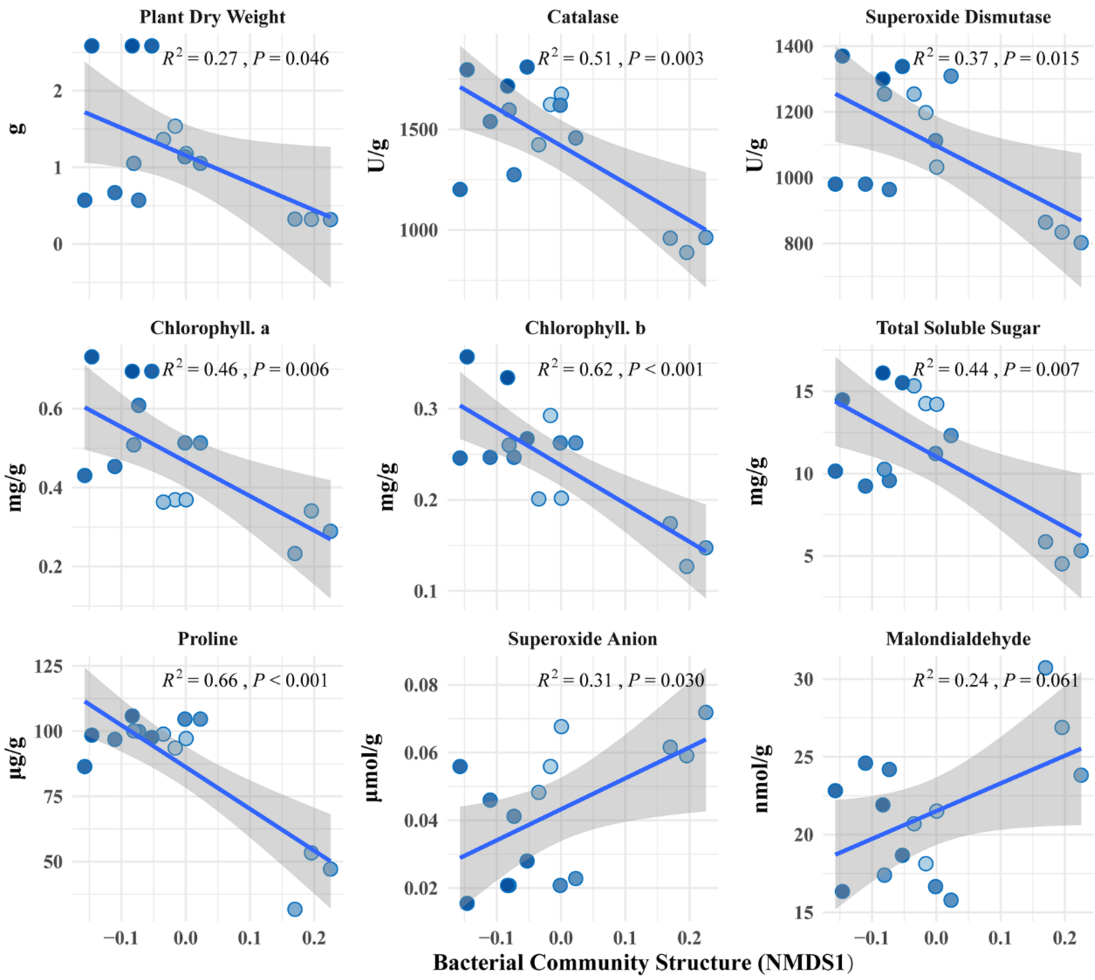
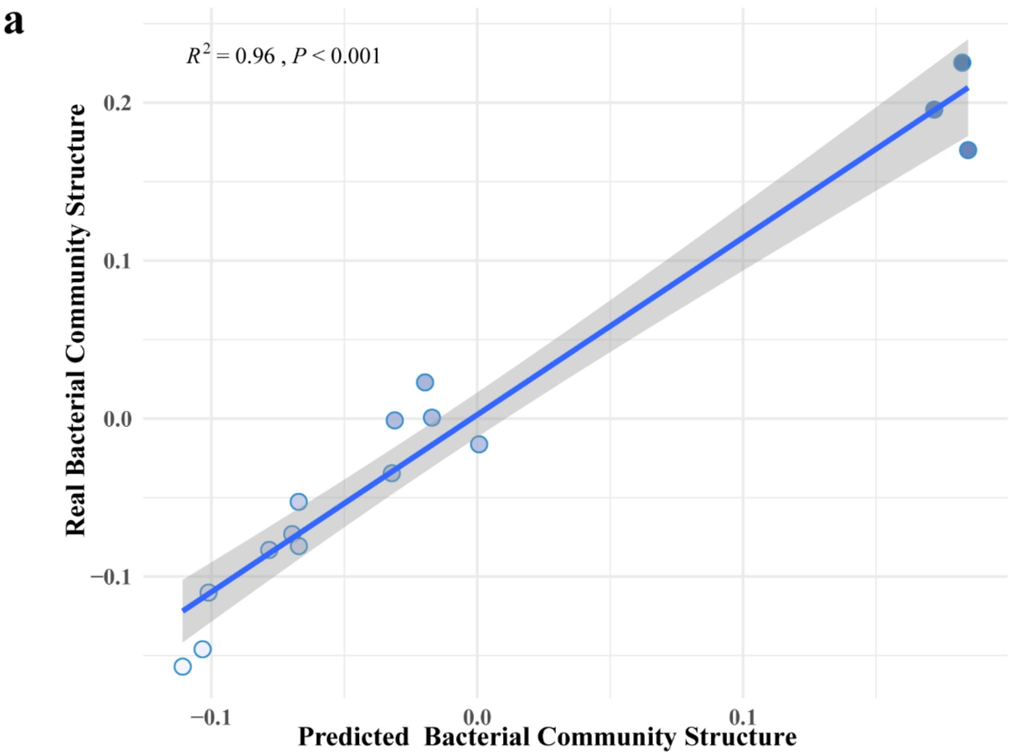


Figure S4. Linear regression relationships between bacterial microbial community structure (NMDS1) and different plant indicators.



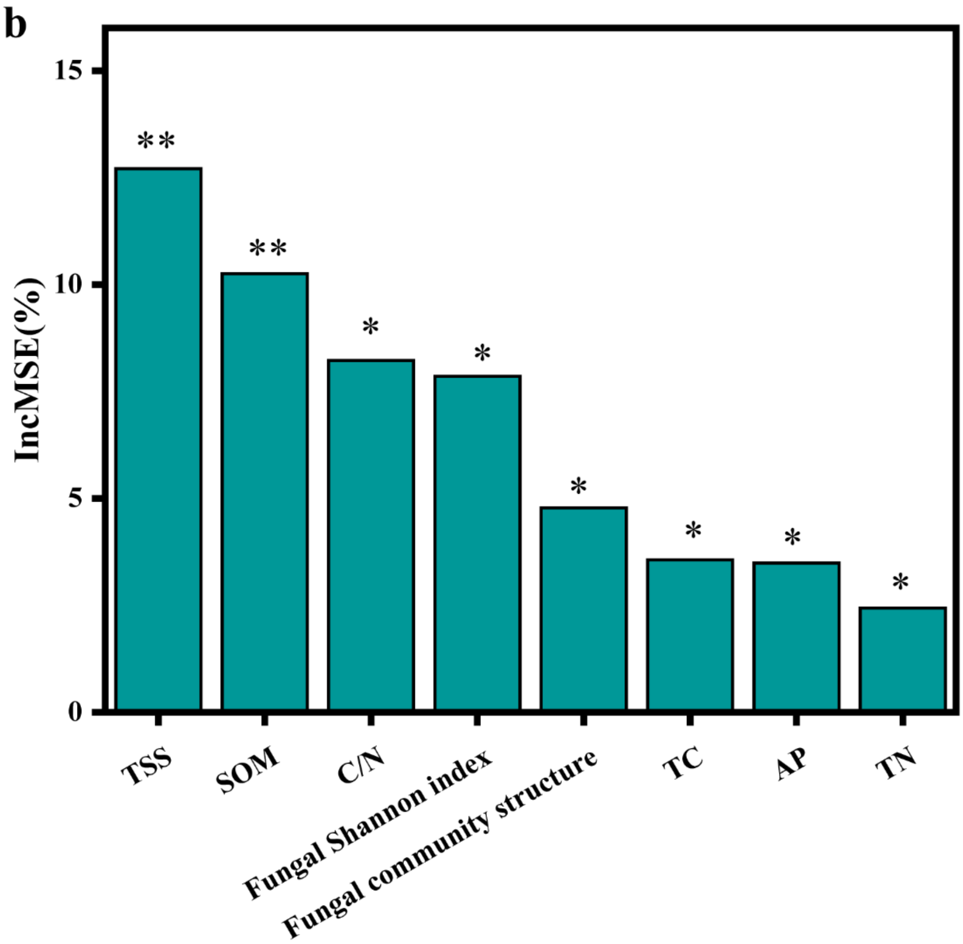


Figure S5. Random forest modeling of the effect of different indicators on bacterial community structure (NMDS1), (a) prediction of model accuracy using linear regression, (b)

the impact of unused factors on bacterial community structure can be measured by the incMSE value.

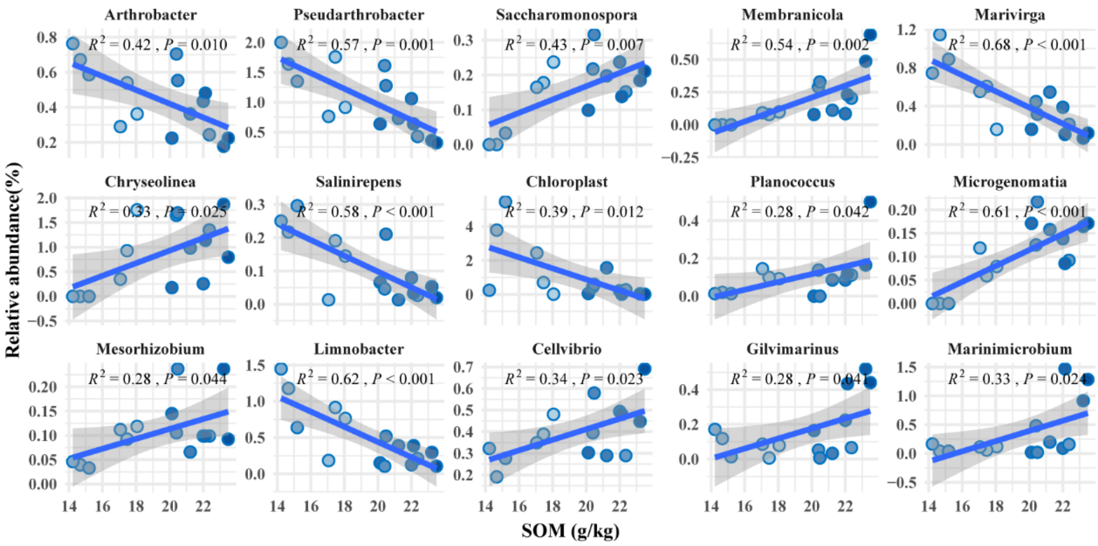


Figure S6. Linear regression relationship between SOM and bacterial taxa (genus level).

Chao index

The Chao1 index uses the Chao1 algorithm to estimate the number of species (such as ASV) in the sample. This algorithm is commonly used in ecology to estimate the total number of species and was proposed by Chao in 1984. The calculation formula used in this analysis is as follows:

$$S_{Chao1} = S_{obs} + \frac{n_1(n_1-1)}{2(n_1+1)} \quad \text{(S1)}$$

S_{Chao1} = the estimated richness

S_{obs} = the observed number of species

n_1 = the number of OTUs with only one sequence (i.e. "singletons")

n_2 = the number of OTUs with only two sequences (i.e. "doubletons")

Shannon index

The Shannon index is a measure used to estimate microbial diversity in a sample. It is similar to Simpson's diversity index and is often used to reflect the alpha diversity of a community. The larger the Shannon value, the higher the diversity of the community. The calculation formula used in this analysis is as follows:

$$H_{shannon} = -\sum_{i=1}^{S_{obs}} \frac{n_i}{N} ln \frac{n_i}{N} \quad \text{(S2)}$$

S_{obs} = the observed number of species

n_i = the number of individuals in OTU i

N = the total number of individuals in the community

Shannoneven index

Shannon evenness index, also known as Shannon's evenness index, is a measure used to assess the evenness of species distribution in ecological communities. It is derived from the Shannon-Wiener Diversity Index and takes into account species richness. The calculation formula used in this analysis is as follows:

$$E = \frac{-\sum_{i=1}^{S}(p_i * lnp_i)}{lns} \quad \text{(S3)}$$

p_i = the proportion of species i to all species
S = is the total number of species in the community