

The Characteristics of Saemangeum Soil Microbial Community with Land use type.

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ABSTRACT

Paddy-upland rotation fields are unique from other soils, because they are associated with frequent cycling between wetting and drying under anaerobic and aerobic conditions; such rotations biological effectiveness of soil nutrient elements varied with seasons, increase the diversity of soil organisms.

The objective of this study was to evaluate characteristics of soil microbial community in Saemangeum reclaimed land. The analysis was carried out using the illumine Mseq system for DNA sequencing of the bacterial 16s rRNA genes in soil. Land use type of Saemangeum reclaimed land was found to have significant influences on the bacterial community diversity and composition.

Proteobacteria, Actinobacteria, Acidbacteria were found in higher abundance in all treatments. In the PUU treatment, Proteobacteria increased by 4.2% compared to before the experiment. It showed a positive correlation with calcium and magnesium. Our results indicated that differences observed in bacterial diversity and composition were related to land use types.

Introduction

Reclaimed land have become important parts of sustainable development strategies in many countries. However, it remains unclear what influence reclaimed land might have on the soil bacterial community. There is a considerable dearth of information regarding the responses of soil microbial communities to edaphic factors, vegetation, and seasons, which are important driving factors determining soil microbial diversity and community composition.

Materials and Methods

❖ Experimental Site

- Saemangeum Reclaimed Tidal Land (35°49'N, 126°41'E) in Korea
- ❖ Soil Sampling depth : 0 ~ 20cm
- ❖ Soil sampling date : 2018~2020 late October
- ❖ Experimental analysis : After Soil DNA extraction, the analysis was carried out using the illumine Mseq system for DNA sequencing of the bacterial 16s rRNA genes in soil with EzBioCloud

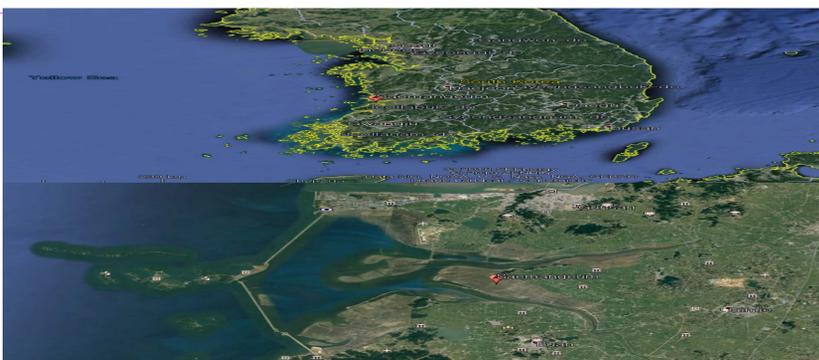


Figure 1. Experimental site located in Saemangeum reclaimed tidal land in Korea (35°49'N, 126°41'E).

Results

Table 1. Changes in soil chemical properties before (2018) and after(2020)experiment under different land utilizing types. (0~20 cm)

Crop rotation	pH (15, H ₂ O)	EC (dS m ⁻¹)	OM (g kg ⁻¹)	AP (mg kg ⁻¹)	Exchangeable cation				CEC	ESP (%)
					Ca	K	Mg	Na		
Before	6.6	1.62	2.10	23	1.0	0.52	1.8	0.83	6.0	13
After										
PPP	5.7	0.98	3.7	30.1	1.7	0.30	2.09	0.86	6.2	13.9
PUU	6.4	0.16	3.9	30.6	1.6	0.30	2.80	0.35	6.6	5.4
UUU	7.0	0.13	3.6	31.7	1.4	0.35	2.67	0.37	6.3	5.3
NNN	7.1	0.36	2.9	20.5	1.5	0.48	2.35	0.90	6.4	13.9
Optimal range	6.0-6.5	<2.0	20-30	150-250	5.0-6.0	0.45-0.55	1.5-2.0	-	10-15	-

* EC : Electrical Conductivity, OM : Organic matter, AP: available phosphorus, CEC: cation Exchange Capacity, ESP: Exchangeable Sodium Percentage ** PPP : Paddy-Paddy-Paddy, PUU : Paddy-Upland-Upland, UUU :Upland-Upland-Upland, NNN : Natural-Natural-Natural

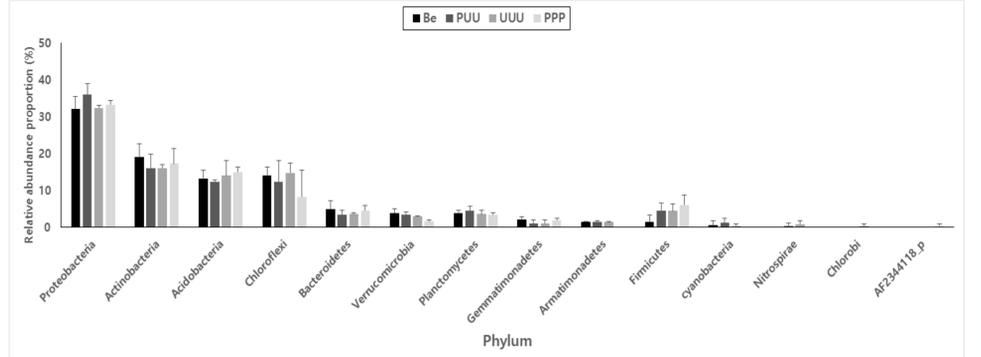


Figure 2. Relative abundances of the bacterial phyla in soils according to land use type in Saemangeum reclaimed land.

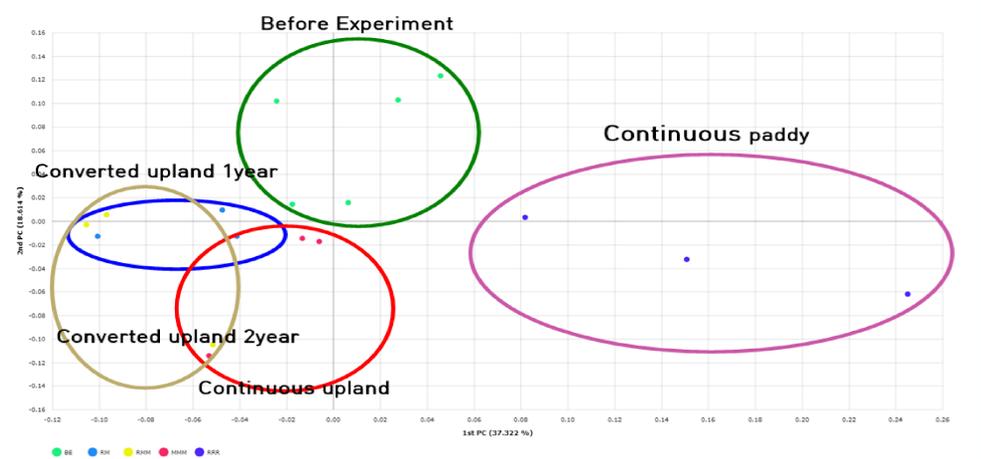


Figure 3 Principal component analysis of land use type of the 16S rRNA gene fragments from Bacterial communities in Saemangeum reclaimed land from 2018 to 2020.

Table 2. The diversity index and richness of soil microbial communities of five treatment in the Saemangeum reclaimed land.

Treatments	OTU	Shannon	Ace	Chao 1
BE	3,731.4±216.1b	6.8±0.15ns	4,106.2±266.5b	3,956.6±232.6b
PU	3,149.6±182.4b	6.9±0.07ns	3,500.3±60.8b	3,372.6±86.3b
PUU	3,831.6±161.9b	6.8±0.18ns	4,207.0±296.7b	4,061.6±223.8b
UUU	4,707.0±527.7a	7.1±0.05ns	5,117.0±616.8a	4,982.6±562.9a
PPP	4,985.3±1,013.4a	7.1±0.31ns	5,668.0±934.1a	5,425.0±924.7a

Each experiment was replicated three times. Different letters after the values refer to Duncan's test $p < 0.05$

References

1. Yuanyuan Li, Longqian Chen, Hongyu Wen. Changes in the composition and diversity of bacterial communities 13 years after soil reclamation of abandoned mine land in eastern China. Ecol Res (2015) 30: 357-366