

The application of *Bacillus Megaterium* alters soil microbial community composition, bioavailability of soil phosphorus and potassium, and cucumber growth in the plastic shed system of North China

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INTRODUCTION

AIM to investigate the effect of the application of *Bacillus megaterium* on cucumber growth and the bioavailability of soil P and K, and the response of the composition, diversity and structure of soil microbial communities with the inoculation of *Bacillus megaterium*.

BACKGROUND The long-term continuous monocropping and application of large amount of chemical fertilizers have led to a dramatic degradation of soil quality in the intensive vegetable production system. It is important to develop more sustainable, environmentally friendly and high-efficiency agroecosystems for vegetable production in plastic shed systems.

MATERIALS & METHODS

•Treatment: conventional fertilization as control (CON); conventional fertilization with *Bacillus megaterium* (CON+BM); conventional fertilization reduced by 10% P and 10% (or 5%) K from chemical fertilizer with *Bacillus megaterium* (CON+BM-PK1); conventional fertilization reduced by 20% P and 20% (or 10%) K from chemical fertilizer with *Bacillus megaterium* (CON+BM-PK2); 3 replicates

•Bacillus megaterium: microbial inoculant contained the effective strain of *Bacillus megaterium* for 7.0×10^8 cfu mL⁻¹, applied when the cucumber seedlings were transplanted (30 L ha⁻¹) and 80 days after cucumber transplanting (45 L ha⁻¹).

RESULTS

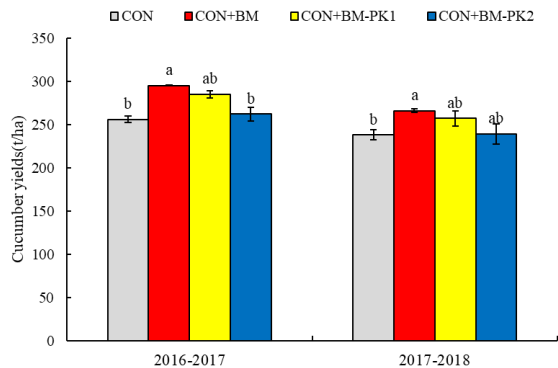


Fig.1. Cucumber yields under different fertilization treatments

Table 1. Amounts of P and K accumulation in different tissues of cucumber plants

Treatments	Nutrients accumulation	2016-2017				2017-2018			
		Fruits	Shoots	Roots	Total	Fruits	Shoots	Roots	Total
CK	P	88.0b	122.0a	8.9c	216.9.9b	98.3a	104.3a	6.0b	208.6a
CK+BM		112.2a	136.2a	13.0a	261.5a	119.4a	108.6a	7.8a	237.0a
CK-PK1+BM		102.0ab	136.8a	11.7ab	250.5ab	116.5a	109.2a	7.1a	232.7a
CK-PK2+BM		92.9b	123.7a	10.6bc	227.3ab	102.7a	119.0a	7.4a	229.1a
CK		567.7b	458.0a	18.2b	1043.9b	488.7b	291.3a	15.7b	795.6a
CK+BM	K	677.8a	543.6a	26.4a	1247.8a	603.7a	329.2a	18.5a	954.1a
CK-PK1+BM		662.4a	527.9a	24.8a	1215.1a	551.5ab	290.6a	16.8ab	858.9a
CK-PK2+BM		574.5b	499.9a	23.6a	1098.1b	511.1b	337.2a	18.1ab	866.4a

Means followed by different letters are significantly different ($P < 0.05$)

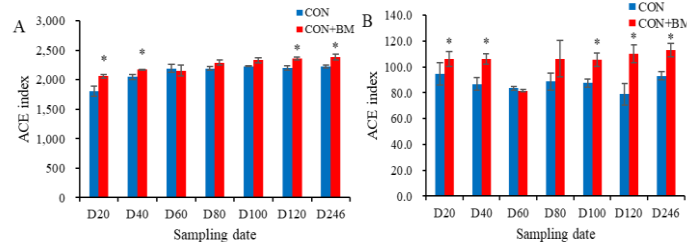


Fig.2. α -diversity indices of soil bacterial (A) and fungal (B) communities under CON+BM treatment and CON

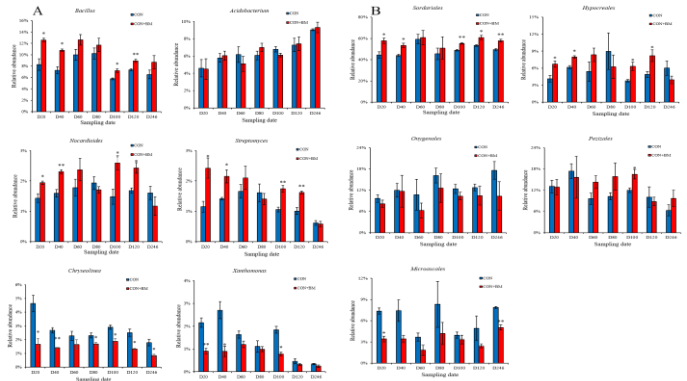


Fig.3. Relative abundances of the dominant bacterial (A) genus and fungal (B) orders under CON+BM treatment and CON

CONCLUSIONS

- Bacillus megaterium* addition increased the yields of cucumber.
- Bacillus megaterium* addition improved the bioavailability of soil phosphorus and potassium.
- Bacillus megaterium* addition increased the richness of soil bacterial and fungal communities.
- Bacillus megaterium* contribute to a more sustainable production system of vegetables in plastic shed.

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