

Supplementary Materials: The Role of Biochar Nanoparticles Performing as Nanocarriers for Fertilizers on the Growth Promotion of Chinese Cabbage (*Brassica rapa* (Pekinensis Group))

Ruiping Yang ^{1,2}, Jiamin Shen ¹, Yuhan Zhang ¹, Lin Jiang ¹, Xiaoping Sun ¹, Zhengyang Wang ³, Boping Tang ^{1,*} and Yu Shen ^{2,*}

¹ Jiangsu Key Laboratory for Bioresources of Saline Soils, Jiangsu Synthetic Innovation Center for Coastal Bio-Agriculture, School of Wetlands, Yancheng Teachers University, Yancheng 224007, China

² Co-Innovation Center for the Sustainable Forestry in Southern China; College of Biology and the Environment, Nanjing Forestry University, Nanjing 210037, China

³ Department of Environmental Sciences; The Connecticut Agricultural Experiment Station, New Haven, CT 06504, USA

* Correspondence: boptang@163.com (B.T.); sheyttmax@hotmail.com or yushen@njfu.edu.cn (Y.S.)

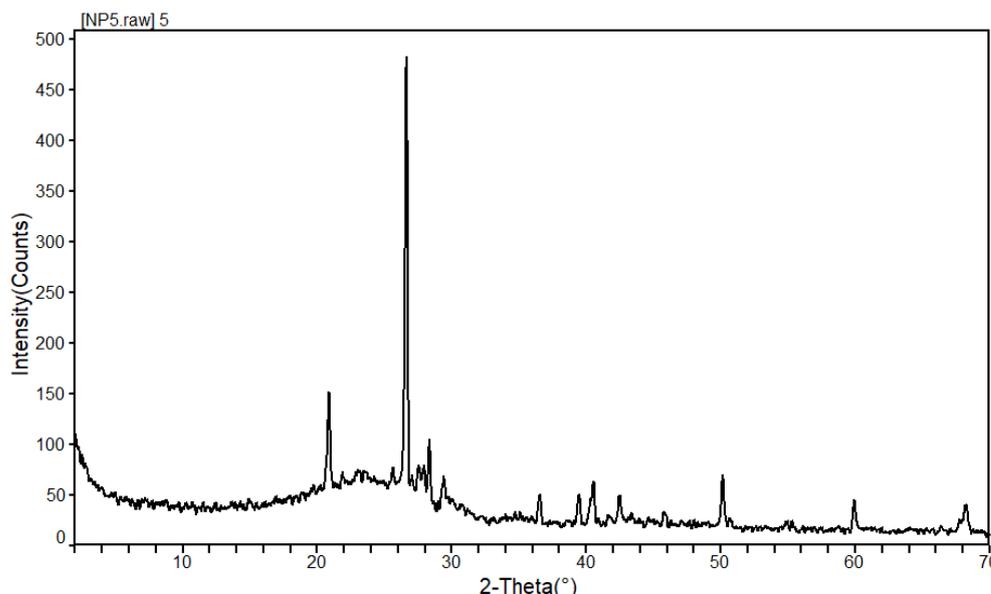


Figure S1. The X-ray diffractometer (XRD) of BNPs.

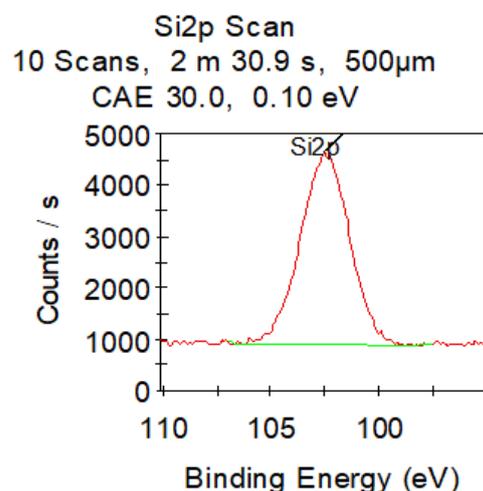


Figure S2. X-ray photoelectron spectroscopy (XPS) of BNPs.

Table S1. The Summary of the Surface-Area and the Pore Size of BNPs.

Index	Content
Surface-Area (m ² /g)	
Single point surface area	46.37
BET Surface Area	53.67
Langmuir Surface Area	76.42
Pore Volume (cm ³ /g)	
Single point adsorption total pore volume	0.12
SF micropore volume	0.01
Pore Size (nm)	
Total adsorption average pore width	9.23
BJH Median pore width	2.21

Table S2. Response Surface Model for Screening Experiment.

Treatments	N	P	K
T1	0	0	0
T2	0	2	2
T3	1	2	2
T4	2	0	2
T5	2	1	2
T6	2	2	2
T7	2	3	2
T8	2	2	3
T9	2	2	0
T10	2	2	1
T11	3	2	2
T12	1	3	2
T13	1	1	2
T14	1	2	1
T15	2	1	1

Table S3. The Treatments for Experiment of Comparison.

Treatments	Biochar NPs	N	K
T1	1	2	2
T2	2	2	2
T3	2	1	1
T4	2	0.5	0.5
T5	2	0	0
T6	0	2	2

Table S4. Plant Weight for Experiment of Comparison.

Treatments	Aboveground Fresh Weight(g)	Underground Fresh Weight(g)	Aboveground Dry Weight(g)	Underground Dry Weight(g)
T1	46.05 ± 2.98 b	2.35 ± 0.29 ab	3.88 ± 0.26 c	0.50 ± 0.05 bc
T2	47.78 ± 1.77 bc	2.17 ± 0.16 ab	3.70 ± 0.03 bc	0.46 ± 0.05 b
T3	62.72 ± 2.80 d	3.67 ± 0.64 bc	4.68 ± 0.27 d	0.78 ± 0.16 d
T4	53.82 ± 1.66 c	5.93 ± 1.54 c	4.54 ± 0.10 d	0.74 ± 0.10 cd
T5	2.55 ± 0.28 a	0.76 ± 0.05 a	0.54 ± 0.05 a	0.10 ± 0.00 a
T6	43.69 ± 2.21 b	3.68 ± 0.66 bc	3.34 ± 0.14 b	0.42 ± 0.06 b

Table S5. Nutrient contents for Experiment of Comparison.

	Treatments	Calcium	Potassium	Magnesium	Sodium	Phosphorus	Sulphur
Aboveground	T1	29.21 ± 1.93 b	30.10 ± 1.02 c	4.57 ± 0.57 b	5.09 ± 0.24 a	2.18 ± 0.10 b	10.04 ± 0.67 cd
	T2	22.94 ± 3.74 b	27.81 ± 2.27 bc	3.11 ± 0.54 a	5.19 ± 0.37 ab	1.79 ± 0.23 ab	7.99 ± 0.98 bc
	T3	13.55 ± 1.68 a	19.74 ± 3.32 a	2.34 ± 0.47 a	5.42 ± 0.56 ab	1.16 ± 0.23 a	6.29 ± 1.42 ab
	T4	7.15 ± 0.16 a	20.78 ± 2.83 ab	2.11 ± 0.16 a	6.60 ± 0.56 b	1.42 ± 0.22 ab	6.57 ± 0.90 ab
	T5	7.20 ± 0.36 a	28.02 ± 1.77 bc	2.92 ± 0.13 a	8.11 ± 0.50 c	4.49 ± 0.49 c	4.44 ± 0.14 a
	T6	24.86 ± 5.92 b	32.73 ± 2.48 c	3.30 ± 0.39 a	5.25 ± 0.47 ab	2.13 ± 0.29 b	11.53 ± 1.79 d
Underground	T1	23.53 ± 2.20 d	52.70 ± 1.42 b	2.45 ± 0.13 abc	6.51 ± 0.39 ab	1.50 ± 0.17 a	7.34 ± 0.88 b
	T2	23.77 ± 0.74 d	51.41 ± 3.59 b	2.42 ± 0.09 bc	8.61 ± 0.98 bc	1.71 ± 0.10 a	8.32 ± 0.45 b
	T3	16.59 ± 0.71 c	48.40 ± 1.94 b	2.37 ± 0.13 bc	7.84 ± 0.48 abc	1.63 ± 0.09 a	7.33 ± 0.48 b
	T4	12.16 ± 0.85 b	49.10 ± 2.70 b	2.56 ± 0.12 c	9.76 ± 1.27 c	1.88 ± 0.07 a	6.84 ± 0.48 b
	T5	7.16 ± 0.49 a	34.61 ± 1.10 a	1.83 ± 0.10 ab	5.76 ± 0.62 a	4.75 ± 0.28 b	3.56 ± 0.22 a
	T6	21.52 ± 1.75 d	55.77 ± 3.14 b	2.10 ± 0.08 a	6.78 ± 0.74 ab	1.81 ± 0.21 a	7.32 ± 0.27 b

Note, Data are shown in mean ± SE (standard error); Different letters indicate the significant differences with $p < 0.05$.