



Figure S1 Diagram of soil column experimental design (Column height: 50cm, Inner diameter: 10cm). Different pyrolysis wheat straw biochar combined with fertilizer level was mixed with 0-10cm soil layer (i.e. CK: control treatment without biochar and fertilizer; CF: conventional fertilizer applied; RF: reduce 20% fertilizer compared with CF; FBC300: 300°C biochar combined with RF; FBC500: 500°C biochar combined with RF; FBC700: 700°C biochar combined with RF). Silica sands were placed at the bottom to keep column aeration, and unwoven was twined at inward sampling mouth to against blocking.

Table S1 Characteristics of the profile (0-40cm) soils filled in column in the present study

Soil profile	pH	SOM (g kg ⁻¹)	AK (mg kg ⁻¹)	AP (mg kg ⁻¹)	CEC (cmol kg ⁻¹)	TN (g kg ⁻¹)
0-10cm	7.38±0.21b	32.22±0.44a	134.40±1.39a	20.12±0.62a	18.62±0.26a	1.21±0.13a
10-20cm	7.59±0.13ab	24.58±0.52b	59.10±5.03b	13.80±1.81b	20.18±2.80a	1.24±0.17a
20-30cm	7.63±0.03a	10.97±1.10c	39.61±1.00c	7.55±0.38c	19.87±3.60a	0.39±0.06b
30-40cm	7.72±0.03a	6.53±0.43d	38.23±1.12c	5.66±0.48c	18.31±1.30a	0.26±0.05b
BC type	pH	DOC(g kg ⁻¹)	Ec(us cm ⁻¹)	CEC(cmol kg ⁻¹)	TC (%)	TN (%)
BC300	10.13±0.07c	1.14±0.04b	315±2.00c	74.67±1.16a	59.46±0.83b	1.07±0.01a
BC500	10.47±0.07b	0.61±0.09c	422±2.01a	54.37±0.84b	62.63±1.08a	0.96±0.01b
BC700	10.86±0.04a	1.45±0.05a	400±2.52b	35.66±1.05c	60.88±1.06ab	1.08±0.00a

Indicates: SOM: soil organic matter; AK: available potassium; AP: available phosphorus; CEC: cation exchange capacity; TN: total nitrogen; TC: total carbon; DOC: dissolved organic carbon; Ec: electrical conductivity; BC300, BC500 and BC700 represent wheat straw biochar produced at 300 °C, 500 °C and 700 °C, respectively. Different letters indicate statistical differences between different treatments ($p < 0.05$).

