Supplementary Materials

Table S1 Mean table of soil properties under the six experimental treatments. Data are the mean with standard errors. Lowercase letter in the same column and in the same season represents significant differences among experimental treatments at the level of 0.05.

Growing season	Treatment	Soil temperature (℃)	Soil moisture (%)	NO_3^--N (mg/kg)	NH_4^+-N (mg/kg)
2020-2021 Winter wheat	C0	9.99±0.07c	22.00±1.31a	25.43±1.30c	31.12±1.52ab
	C1	10.01±0.07c	21.66±1.46a	28.22±1.72bc	32.04±1.25a
	C2	10.21±0.11b	21.72±1.70a	28.57±1.81abc	30.16±1.64ab
	C3	10.42±0.05a	19.91±1.54ab	30.58±1.96ab	30.05±1.68ab
	C4	10.55±0.05a	20.49±1.42ab	31.73±2.75a	30.80±1.47ab
	CS	10.43±0.09a	18.45±0.76b	31.96±1.97a	29.26±1.30b
2021 Summer maize	C0	24.85±0.07d	28.43±1.36abc	27.48±2.31d	27.62±1.56ab
	C1	25.13±0.12c	31.02±2.07a	33.30±1.76c	29.25±1.59a
	C2	25.50±0.18b	30.03±1.78ab	34.88±2.46c	24.45±1.65cd
	C3	25.58±0.14b	27.91±1.08bc	39.47±2.97b	25.21±1.31bc
	C4	25.97±0.12a	27.69±1.61bc	42.15±1.62ab	25.02±1.06c
	CS	25.78±0.10a	26.87±1.05c	43.69±2.12a	22.35±1.33d
2021-2022 Winter wheat	C0	8.11±0.18b	24.28±0.66a	21.87±1.68c	53.29±2.84ab
	C1	8.41±0.16a	23.92±1.05a	24.62±1.48bc	55.90±3.86a
	C2	7.79±0.13c	22.96±1.02a	24.77±1.13ab	54.39±4.99ab
	C3	8.21±0.11ab	23.11±1.12a	26.18±1.86ab	51.86±3.85ab
	C4	8.35±0.13ab	23.90±1.30a	27.40±1.80a	50.78±3.16ab
	CS	8.30±0.07ab	22.96±1.09a	26.47±1.18ab	48.95±3.11b
2022 Summer maize	C0	25.31±0.07e	29.18±0.91a	27.45±1.75c	25.03±2.83abc
	C1	25.39±0.09de	28.83±1.07a	31.16±1.49ab	22.03±1.41cd
	C2	25.51±0.10cd	29.22±1.20a	28.66±2.11bc	20.42±2.00d
	C3	25.62±0.09bc	29.25±1.18a	32.34±2.38a	28.23±1.96a
	C4	25.79±0.06a	29.89±1.13a	32.61±2.17a	23.62±1.30bcd
	CS	25.72±0.06ab	28.34±1.31a	31.83±1.94ab	25.62±1.67ab

Table S2 Compared with C0, the increased value of nosZ gene copy numbers under the six experimental treatments.

Treatment	9 October 2020	9 March 2021	9 June 2021	25 June 2021	10 August 2021	28 September 2021
C0	/	/	/	/	/	/
C1	-5.34×10^6	3.28×10^6	3.88×10^6	2.47×10^6	5.09×10^6	-1.11×10^6
C2	4.26×10^5	4.48×10^6	7.71×10^6	2.37×10^6	6.73×10^6	2.48×10^6
C3	2.23×10^6	5.21×10^6	1.06×10^7	6.02×10^6	8.28×10^6	2.23×10^6
C4	3.62×10^6	5.11×10^6	8.91×10^6	5.75×10^6	9.59×10^6	4.37×10^6
CS	-1.70×10^6	5.90×10^6	4.71×10^6	-4.87×10^6	7.42×10^5	-1.33×10^6
Treatment	7 October 2021	6 March 2022	31 May 2022	7 June 2022	9 August 2022	2 October 2022
C0	/	/	/	/	/	/
C1	2.67×10^6	-6.38×10^5	1.40×10^6	1.84×10^6	4.26×10^5	6.51×10^6
C2	1.07×10^6	9.86×10^5	4.45×10^6	5.88×10^6	1.11×10^6	9.18×10^6
C3	2.02×10^6	3.60×10^6	6.66×10^6	7.20×10^6	1.34×10^6	1.03×10^7
C4	3.60×10^6	2.96×10^6	4.30×10^6	9.78×10^6	8.07×10^6	1.14×10^7
CS	2.24×10^6	4.10×10^5	4.21×10^5	2.51×10^6	-1.36×10^6	2.90×10^6

Supplementary figure legends

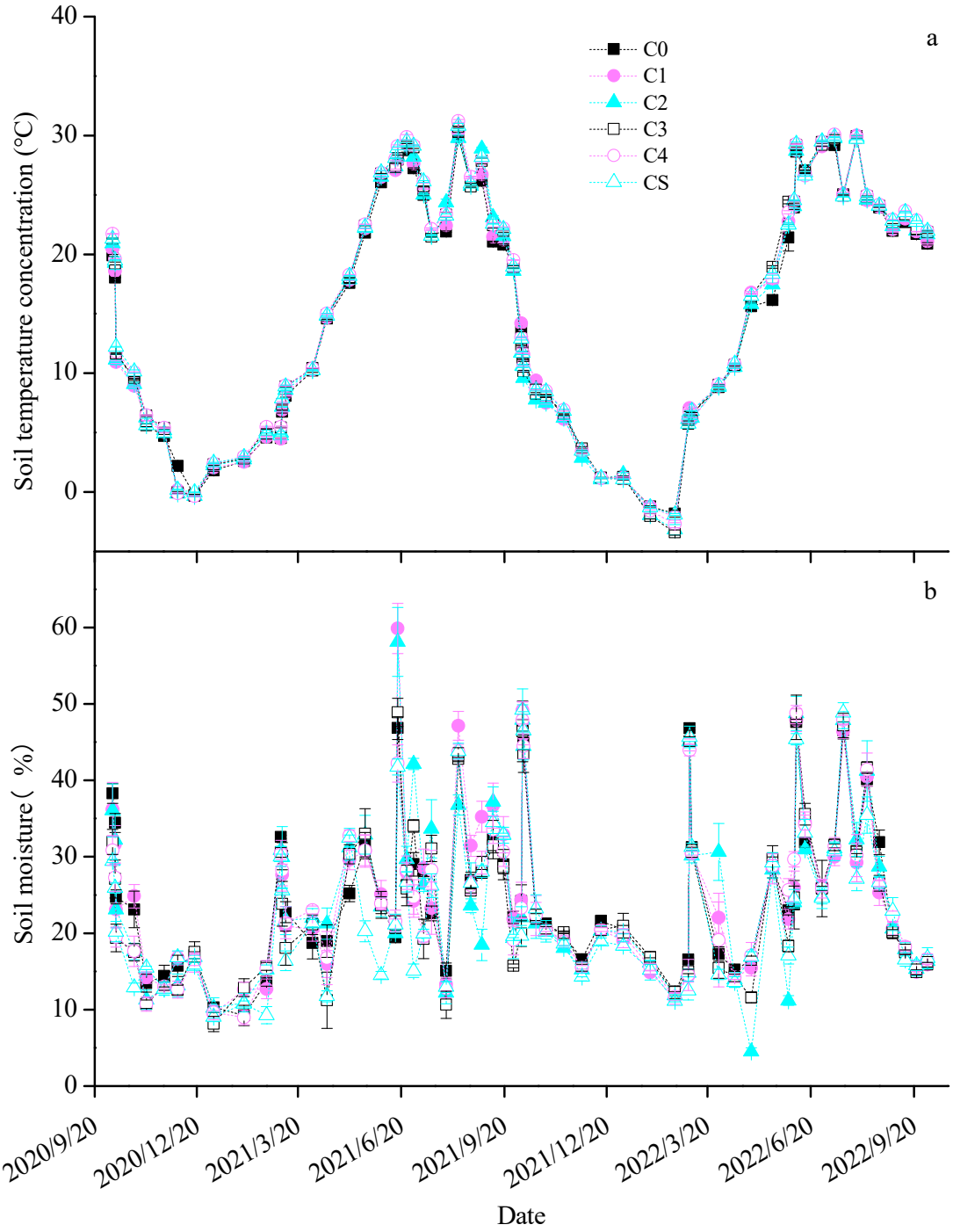


Figure S1 Variation of the soil temperature (a) and soil moisture (b) under the six experimental treatments. Data are shown as the means with standard errors.

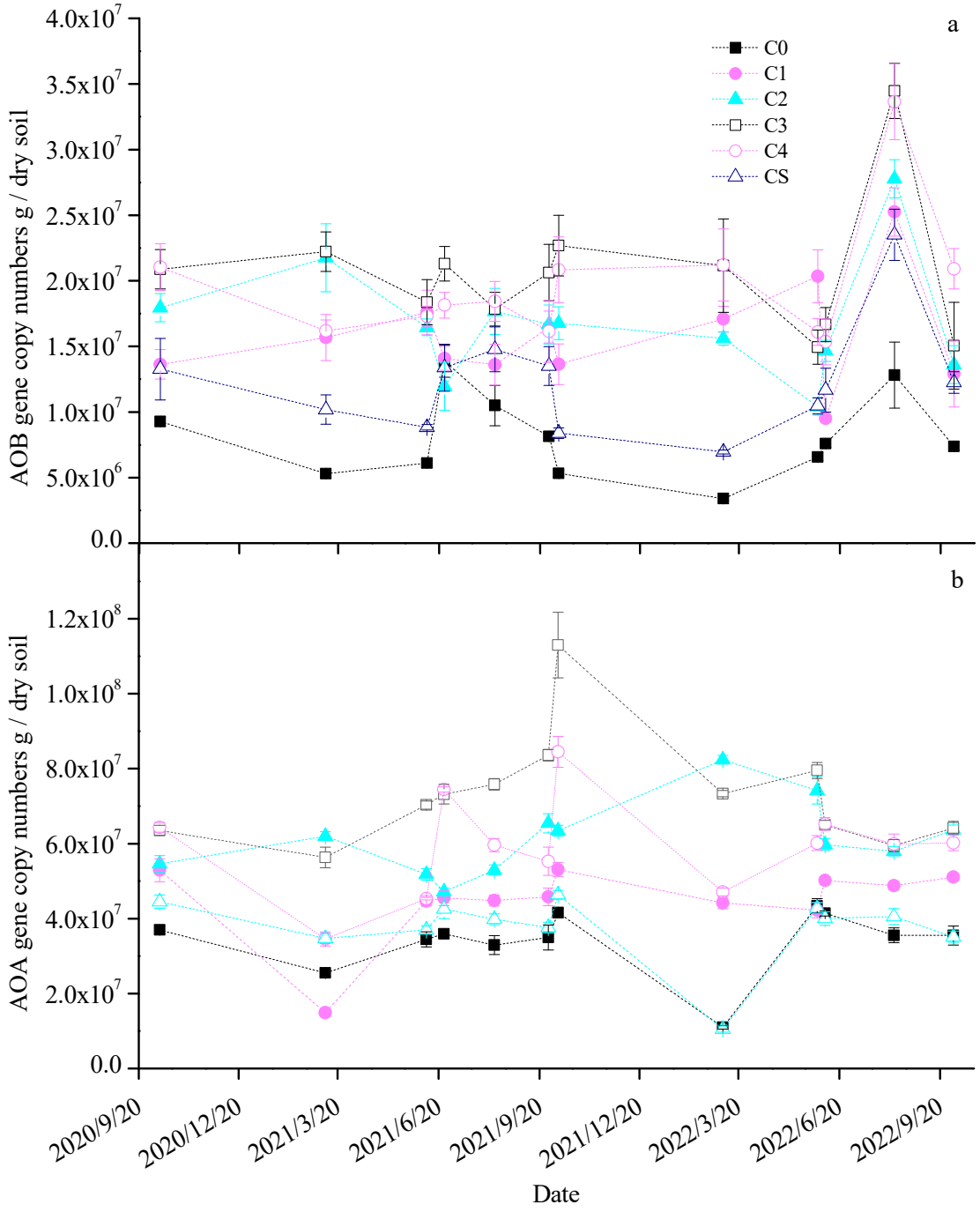


Figure S2 Variation of the AOB (a) and AOA (b) gene copy numbers under the six experimental treatments. Data are shown as the means with standard errors.