Li, Tengteng; Zhang, Yunlong; Bei, Shuikuan; Li, Xiaolin; Reinsch, Sabine; Zhang, Hongyan; Zhang, Junling. 2020. **Contrasting impacts of manure and inorganic fertilizer applications for nine years on soil organic carbon and its labile fractions in bulk soil and soil aggregates.**

The definitive version was published in*CATENA*, 194, 104739. 12, pp. 10.1016/j.catena.2020.104739

Supplementary materials

Li et al., Contrasting impact of 9-year application of manure and inorganic fertilizers on soil organic carbon and its labile fractions in bulk soil and aggregates

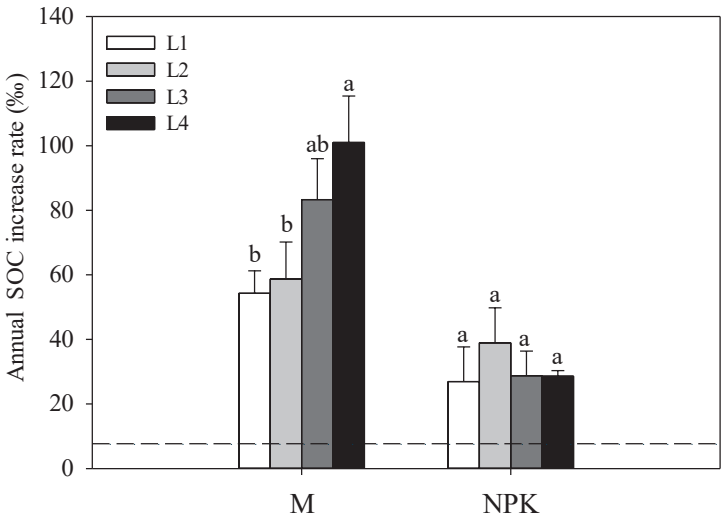

Fig. S1 Annual SOC increase rates at the harvest of wheat and maize from 2007 to 2016. L1, L2, L3, L4 indicated the annual application rates of manure (M) at 3000, 6000, 9000, and 12000 kg ha^{-1} $crop^{-1}$ respectively, and the equivalent amounts of nutrients in the inorganic (NPK) treatments. Data are mean ± SE (n=3). The dashed line is the value of the Control. Lowercase letters indicate significant differences among fertilizer application rates of the same fertilizer type (P<0.05).

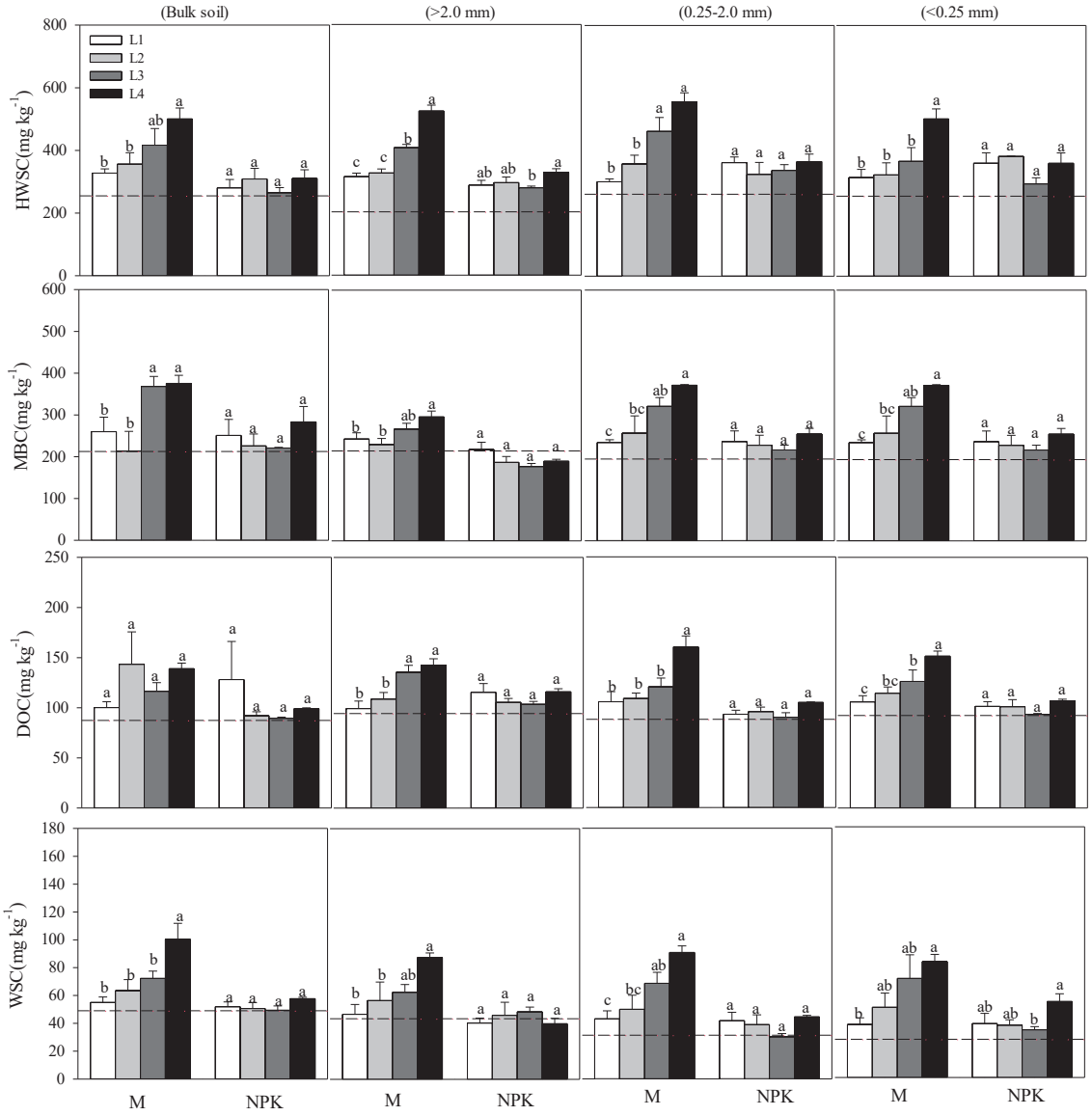

Fig. S2 Concentrations of labile organic carbon (HWSC, WSC, MBC, DOC) within bulk soil and aggregates in all the treatments at wheat harvest. L1, L2, L3, L4 indicated the annual application rates of manure (M) at 3000, 6000, 9000, and 12000 kg $ha^{-1}crop^{-1}$ respectively, and the equivalent amounts of nutrients in the inorganic (NPK) treatments. Data are mean ± SE (n=3). Dashed lines indicate the value of the Control. Lowercase letters indicate significant differences among fertilizer application rates of the same fertilizer type (P<0.05).

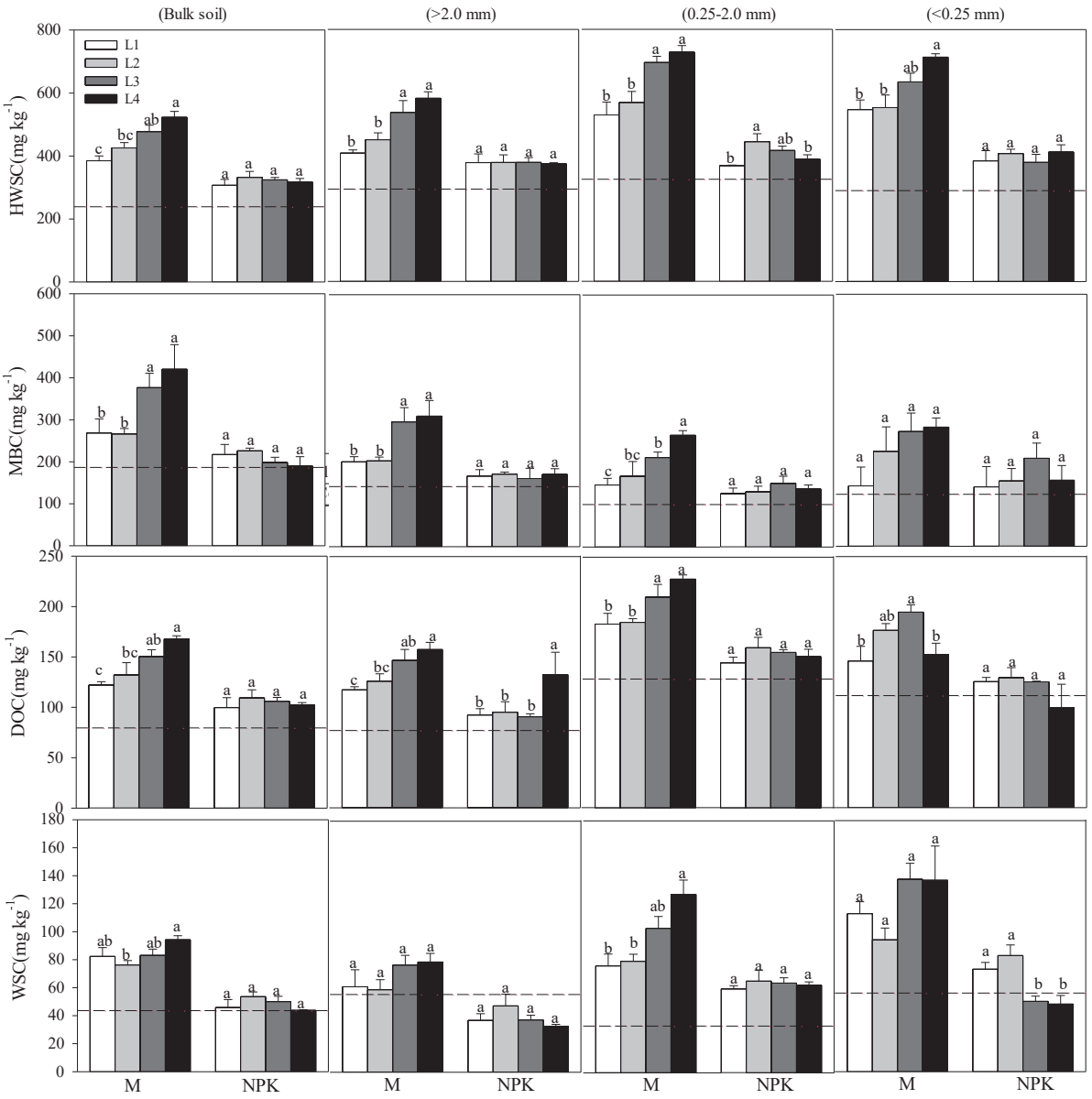

Fig. S3 Concentrations of labile organic carbon (HWSC, WSC, MBC, DOC) within bulk soil and aggregates in all the treatments at maize harvest. L1, L2, L3, L4 indicated the annual application rates of manure (M) at 3000, 6000, 9000, and 12000 kg $ha^{-1}crop^{-1}$ respectively, and the equivalent amounts of nutrients in the inorganic (NPK) treatments. Data are mean ± SE (n=3). Dashed lines indicate the value of the Control. Lowercase letters indicate significant differences among fertilizer application rates of the same fertilizer type (P<0.05).

Table S1 Pearson correlations between mean weight diameter (MWD) and SOC concentrations and its labile fractions in both bulk soil and aggregates at harvests of wheat and maize

Crops		Bulk soil	>2.0mm	0.25-2.0mm	<0.25mm
Wheat	SOC	.578**	.559**	.619**	ns
	HWSC	.610**	.684**	.539**	.511**
	MBC	.490**	.413*	.601**	.531**
	DOC	ns	.486*	.670**	.627**
	WSC	.694**	.573**	.607**	.562**
Maize	SOC	.587**	.493**	.554**	.558**
	HWSC	.537**	.529**	.566**	.526**
	MBC	.650**	.569**	.470*	ns
	DOC	.527**	ns	.554**	.471*
	WSC	.567**	.682**	.523**	.729**

SOC- soil organic carbon; HWSC - hot water extractable soil organic carbon; MBC - microbial biomass carbon; DOC - dissolved organic carbon; WSC - cold water extractable soil organic carbon. * $P < 0.05$, ** $P < 0.01$, *** $P < 0.001$, ns: non-significant.

Table S2 Effects of long-term manure (M) and inorganic (NPK) fertilization on soil chemical properties in the topsoil of 0-15 cm at harvests of wheat and maize

Crops	Application rates	Fertilizer types	pH (1:2.5)	N_{min} (mg kg^{-1})	Olsen-P (mg kg^{-1})	AK (mg kg^{-1})	Water-extractable cation (mg kg^{-1})			
							Ca^{2+}	Mg^{2+}	K^{+}	Na^{+}
Wheat	CK	Control	8.19 ± 0.01	3.94 ± 0.54	5.80 ± 0.97	100.70 ± 7.14	96.53 ± 2.15	23.05 ± 1.68	25.21 ± 2.20	161.97 ± 4.24
	L1	M	8.14± 0.02a A	6.40 ± 0.79aB	10.70 ± 2.58aC	122.30 ± 3.57bD	120.40 ± 11.32aB	25.40 ± 0.75aA	47.35 ± 10.49aB	173.47 ± 0.89aA
		NPK	7.98 ± 0.05b	4.78 ± 2.07a	13.19 ± 2.29a	157.39 ± 7.14a	106.22 ± 5.14a	25.17 ± 1.32a	39.41 ± 3.87a	138.27 ± 1.57b
	L2	M	8.11 ± 0.02aA	4.85 ± 0.78bAB	15.49 ± 3.02aBC	161.43 ± 11.53aC	107.83 ± 2.45aB	28.15 ± 1.62aA	42.72 ± 6.28aB	149.93 ± 8.77aB
		NPK	8.06 ± 0.02a	7.94 ± 0.63a	13.51 ± 2.54a	185.73 ± 12.87a	109.35 ± 1.01a	24.15 ± 0.66a	57.76 ± 3.53a	133.18 ± 5.44a
	L3	M	8.03 ± 0.03aAB	4.74 ± 0.57bAB	26.32 ± 4.74aB	228.91 ± 10.19aB	108.92 ± 0.22aB	28.87 ± 0.79aA	74.60 ± 8.76aB	157.55 ± 9.81aAB
		NPK	8.04 ± 0.02a	9.28 ± 1.24a	13.53 ± 1.62a	174.93 ± 3.57b	105.80 ± 4.46a	22.14 ± 0.78b	32.85 ± 0.99b	129.62 ± 4.61a
	L4	M	8.03 ± 0.01aB	5.29 ± 0.73bA	36.84 ± 6.03aA	276.15± 13.29aA	147.27 ± 15.37aA	31.16 ± 3.24aA	111.53 ± 8.89aA	146.30 ± 8.10aB
		NPK	7.93 ± 0.01b	10.74 ± 1.25a	20.82 ± 0.73a	253.21 ± 14.22a	122.20 ± 1.46a	24.15 ± 1.10a	56.05 ± 4.80b	115.12 ± 2.05b
Maize	CK	Control	8.27 ± 0.02	13.47 ± 2.36	4.14 ± 0.33	143.69 ± 12.24	130.75 ± 7.92	35.71 ± 2.29	21.69 ± 1.35	75.00 ± 18.57
	L1	M	8.22 ± 0.07aA	35.12 ± 6.44aC	18.85 ± 3.02aC	227.89 ± 12.25aD	141.70 ± 4.14aB	46.20 ± 2.71aB	44.68 ± 8.76aC	111.02 ± 17.27aA
		NPK	8.20 ± 0.06a	19.85 ± 2.97a	10.83 ± 1.19a	193.14 ± 15.41a	170.13 ± 14.10a	43.40 ± 2.82a	29.70 ± 7.18a	90.40 ± 13.60a
	L2	M	8.13 ± 0.08aA	42.93 ± 4.74aBC	27.68 ± 3.16aB	276.00 ± 11.57aC	156.88 ± 0.71aB	50.33 ± 1.26aB	54.90 ± 2.98aBC	84.13 ± 4.84aA
		NPK	8.17 ± 0.02a	29.65 ± 7.13a	19.07 ± 0.56a	238.58 ± 10.94a	164.23 ± 5.00a	40.16 ± 1.68b	43.23 ± 8.99a	89.03 ± 8.72a
	L3	M	8.08 ± 0.06aAB	46.87 ± 9.56aB	43.10 ± 6.40aB	323.14 ± 11.57aB	149.17 ± 3.71aB	51.57 ± 1.91aAB	72.77 ± 12.32aAB	107.68 ± 9.23aA
		NPK	8.12 ± 0.07a	46.06 ± 1.61a	18.94 ± 0.59b	275.99 ± 22.08a	189.68 ± 17.57a	42.96 ± 7.23a	59.25 ± 13.05a	70.70 ± 15.30a
	L4	M	7.96 ± 0.02aB	76.22 ± 8.88aA	59.83 ± 6.89aA	398.95 ± 8.13aA	178.13 ± 10.72aA	65.32 ± 3.42aA	110.53 ± 11.66aA	103.40 ± 14.02aA
		NPK	8.05 ± 0.04a	46.20 ± 8.08b	28.58 ± 3.97b	337.47 ± 17.37b	206.78 ± 15.88a	42.54 ± 3.31b	78.18 ± 4.96a	49.36 ± 8.63b

CK, no fertilizer input; L1, L2, L3, L4 indicated the annual application rates of manure (M) at 3000, 6000, 9000, and 12000 kg ha^{-1} $crop^{-1}$ respectively, and the equivalent amounts of nutrients in the inorganic (NPK) treatments. N_{min} -mineral nitrogen, AK- available potassium. Lowercase letters indicate significant differences between the two fertilizer types at the same application rate; Capital letters indicate significant differences among different application rates (P<0.05).