

Supplementary information for

Soil organic carbon fractions in response to soil, environmental and agronomic factors under cover cropping systems: A global meta-analysis

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Part 1 Supplementary tables and figures:

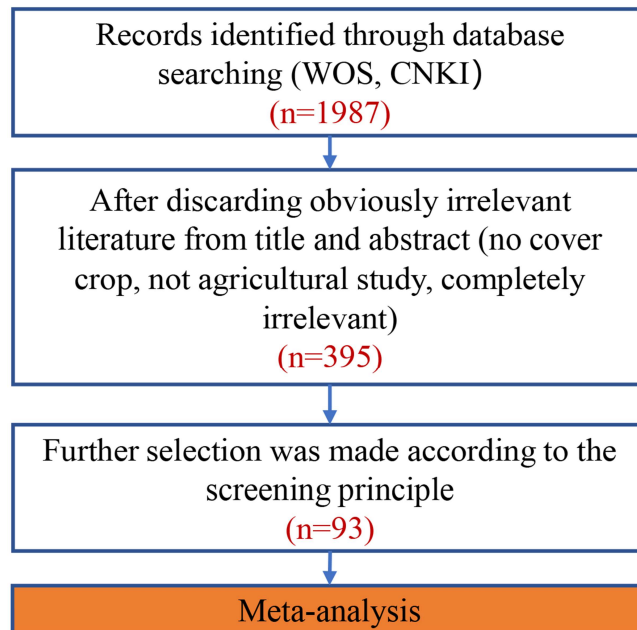


Fig. S1. The systematic criteria that were applied and the number of unique manuscripts that remained at each stage.

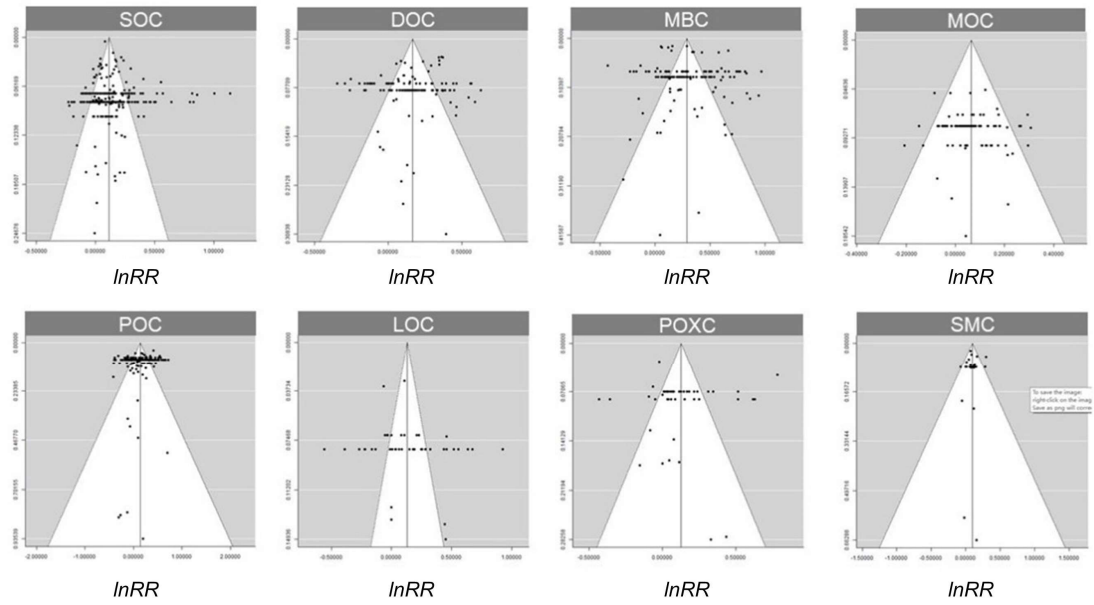


Fig. S2. Funnel diagram of ln-response ratio (lnRR) of soil organic carbon (SOC) and its fractions in response to cover crops. Abbreviations: SOC, soil organic carbon; POC, particulate organic carbon; LFOC, light-fraction organic carbon; MAOC, mineral-associated organic carbon; DOC, dissolved organic carbon; MBC, microbial biomass carbon; POXC, permanganate oxidizable carbon; SMC, short-term mineralizable carbon.

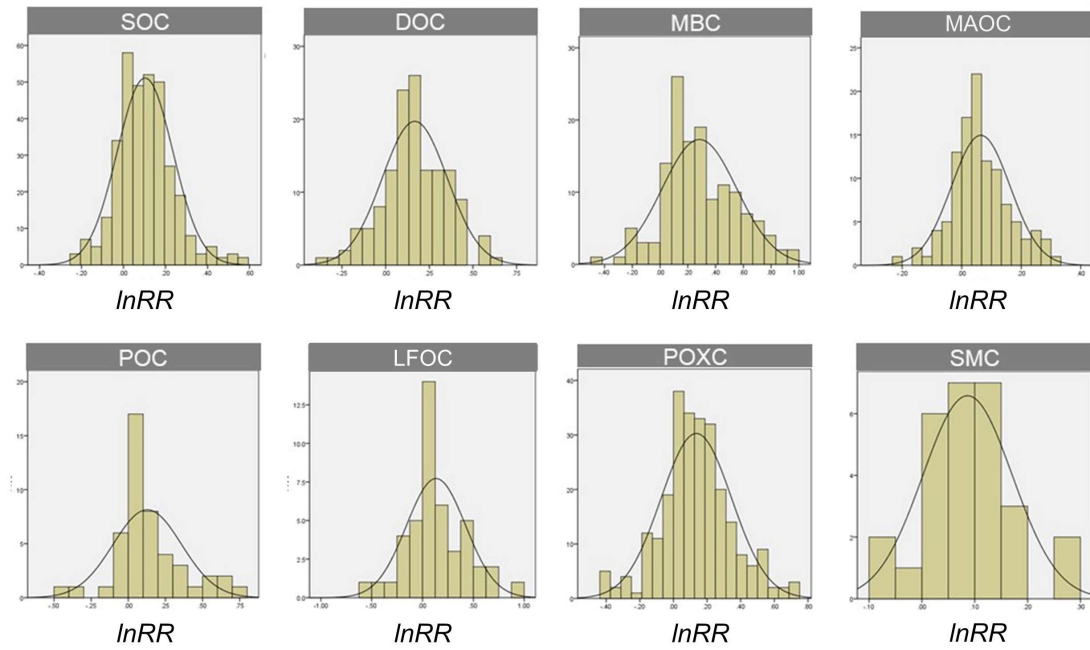


Fig. S3. Normal distribution of ln-response ratio (lnRR) of soil organic carbon (SOC) and its fractions in response to cover crops. Abbreviations: SOC, soil organic carbon; POC, particulate organic carbon; LFOC, light-fraction organic carbon; MAOC, mineral-associated organic carbon; DOC, dissolved organic carbon; MBC, microbial biomass carbon; POXC, permanganate oxidizable carbon; SMC, short-term mineralizable carbon.

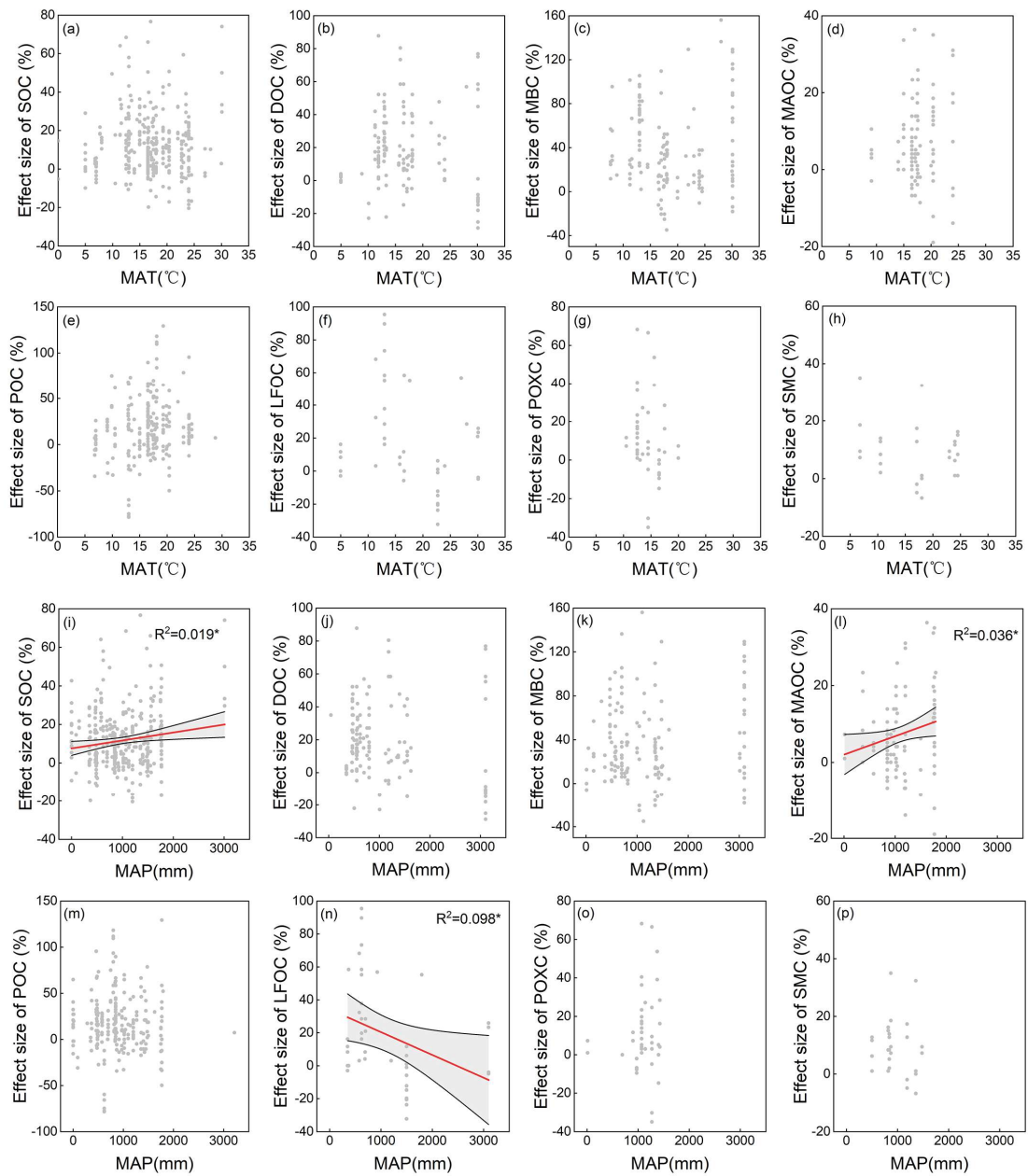


Fig. S4. Results of linear regression analysis of effect size of soil organic carbon (SOC) fractions with mean annual precipitation (MAP) and temperature (MAT). Asterisk indicating a significant correlation between response ratio (RR) of SOC and MAP and MAT under cover crops (*, $p < 0.05$; **, $p < 0.01$; ***, $p < 0.001$). Abbreviations: SOC, soil organic carbon; POC, particulate organic carbon; LFOC, light-fraction organic carbon; MAOC, mineral-associated organic carbon; DOC, dissolved organic carbon; MBC, microbial biomass carbon; POXC, permanganate oxidizable carbon; SMC, short-term mineralizable carbon.

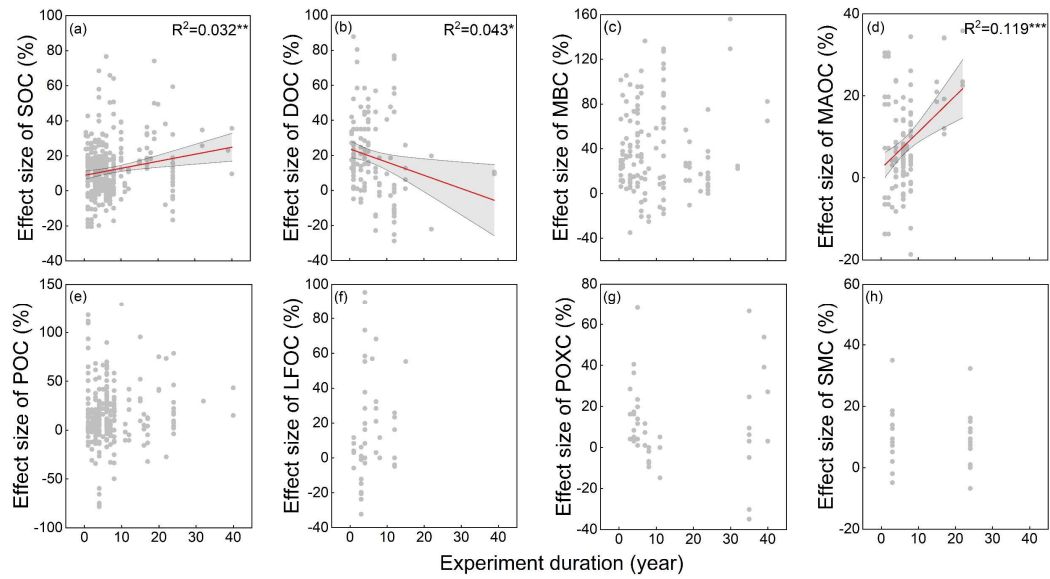


Fig. S5. Variation in the effect sizes of SOC (a), DOC (b), MBC (c), MAOC (d), POC (e), LFOC (f), POXC (g), and SMC (h) according to experimental duration. Red lines indicate linear regressions (*, $p < 0.05$; **, $p < 0.01$; ***, $p < 0.001$). Shaded areas denote the 95% confidence intervals. We did not fit linear curves when the correlation was not significant. Abbreviations: SOC, soil organic carbon; POC, particulate organic carbon; LFOC, light-fraction organic carbon; MAOC, mineral-associated organic carbon; DOC, dissolved organic carbon; MBC, microbial biomass carbon; POXC, permanganate oxidizable carbon; SMC, short-term mineralizable carbon.

Table S1. Summary of effect sizes for soil organic carbon (SOC) and its fractions response to cover crops, reporting global estimate, its 95% confidence interval, p-value, number of observations (n), total between-study heterogeneity (τ^2), and fail-safe number.

	n	Estimate	Lower bound	Upper bound	p-Value	τ^2	Fail-safe number
SOC	340	0.109	0.093	0.125	<0.001	82.135	99655
DOC	138	0.167	0.136	0.197	<0.001	85.645	40958
MBC	141	0.288	0.248	0.327	<0.001	93.865	119258
MAOC	120	0.064	0.047	0.082	<0.001	29.843	3122
POC	255	0.142	0.116	0.16	<0.001	84.061	70105
LFOC	44	0.131	0.053	0.209	<0.001	92.268	1849
POXC	47	0.126	0.054	0.199	<0.001	91.048	2255
SMC	28	0.098	0.064	0.131	<0.001	35.579	450

Abbreviations: SOC, soil organic carbon; POC, particulate organic carbon; LFOC, light-fraction organic carbon; MAOC, mineral-associated organic carbon; DOC, dissolved organic carbon; MBC, microbial biomass carbon; POXC, permanganate oxidizable carbon; SMC, short-term mineralizable carbon.

Table S2. The effect test summary of various factors on each effect size of soil organic carbon (SOC) and SOC fractions under the Moderators Model (Permuted Meta-regression). Q_m represents the total heterogeneity among covariate levels explained by the model, and τ^2 represents total between-study heterogeneity.

	Moderators	Q_m	DF	p-Value	τ^2
SOC	MAT	5.89	1	0.012	2.00
	MAP	0.378	2	0.828	0.00
	Land use type	10.7	3	0.014	33.51
	Soil order	34	8	0.001	9.33
	Soil layer	4.31	1	0.038	1.009
	Cover crops type	2.14	2	0.344	0.13
	Experimental duration	2.91	3	0.396	0.10
	Tillage intensity	3.16	1	0.075	0.87
	Cover crops utilization method	5.88	2	0.053	1.52
DOC	MAP	6.26	2	0.044	4.04
	MAT	12.1	1	0.001	9.11
	Land use type	1.78	3	0.619	0.00
	Soil order	15.5	7	0.030	7.59
	Soil layer	1.03	1	0.311	0.00
	Cover crops type	0.728	2	0.695	0.00
	Experimental duration	18.3	3	0.001	13.10
	Tillage intensity	1.52	2	0.467	0.00
	Cover crops utilization method	12.5	2	0.002	8.46
MBC	MAT	0.058	1	0.809	0.00
	MAP	8.2	2	0.017	4.25
	Land use type	11.5	3	0.009	5.98
	Soil order	33.	7	1.83e-05	16.36
	Soil layer	0.79	1	0.374	0.00
	Cover crops type	9.26	2	0.009	4.77
	Experimental duration	5.67	4	0.129	2.0214
	Tillage intensity	1.8	2	0.408	0.00
	Cover crops utilization method	12.5	2	0.002	7.06
MAOC	MAT	0.478	1	0.494	0.00
	MAP	0.769	2	0.681	0.00
	Land use type	3.15	1	0.076	5.36
	Soil order	27.9	6	0.0001	1.45
	Soil layer	0.498	1	0.481	0.00
	Cover crops type	1.17	2	0.558	0.00
	Experimental duration	24.8	4	5.41e-05	47.60
	Tillage intensity	0.01	1	0.956	0.00

	Cover crops utilization method	1.54	2	0.463	0.00
POC	MAT	6.91	1	0.008	2.42
	MAP	2.5	2	0.287	0.14
	Land use type	0.177	2	0.915	0.00
	Soil order	16	8	0.0426	3.97
	Soil layer	0.407	1	0.523	0.00
	Cover crops type	0.707	2	0.702	0.00
	Experimental duration	1.28	3	0.734	0.00
	Tillage intensity	0.39	1	0.532	0.00
	Cover crops utilization method	10	2	0.007	3.17
LFOC	MAT	0.68	1	0.409	0.00
	MAP	5.38	2	0.068	7.92
	Land use type	17.8	2	0.001	29.31
	Soil order	47	4	1.54e-09	54.84
	Soil layer	2.66	1	0.013	4.15
	Cover crops type	15.4	2	0.001	25.27
	Experimental duration	4.15	2	0.126	4.74
	Tillage intensity	22.4	1	2.19e-06	34.96
	Cover crops utilization method	0.199	2	0.905	0.00
POXC	MAP	0.359	1	0.549	0.00
	Land use type	0.001	1	0.978	0.00
	Soil order	23.3	6	0.001	32.56
	Soil layer	1.89	1	0.17	3.37
	Cover crops type	3.4	2	0.183	5.49
	Experimental duration	6.25	3	0.100	7.61
	Tillage intensity	0.821	2	0.663	0.00
	Cover crops utilization method	0.426	2	0.808	0.00
	MAP	1.08	1	0.299	2.84
SMC	Soil order	3.22	4	0.522	0.00
	Soil layer	21	27	0.784	1.70
	Cover crops type	1.64	2	0.441	4.17
	Experimental duration	1.08	1	0.299	2.84
	Cover crops utilization method	2.68	2	0.262	8.01

Abbreviations: DF, degrees of freedom; SOC, soil organic carbon; POC, particulate organic carbon; LFOC, light-fraction organic carbon; MAOC, mineral-associated organic carbon; DOC, dissolved organic carbon; MBC, microbial biomass carbon; POXC, permanganate oxidizable carbon; SMC, short-term mineralizable carbon; MAT, mean annual temperature; MAP, mean annual precipitation.

Part 2 The list of the 93 papers that the data were extracted from for this meta-analysis.

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