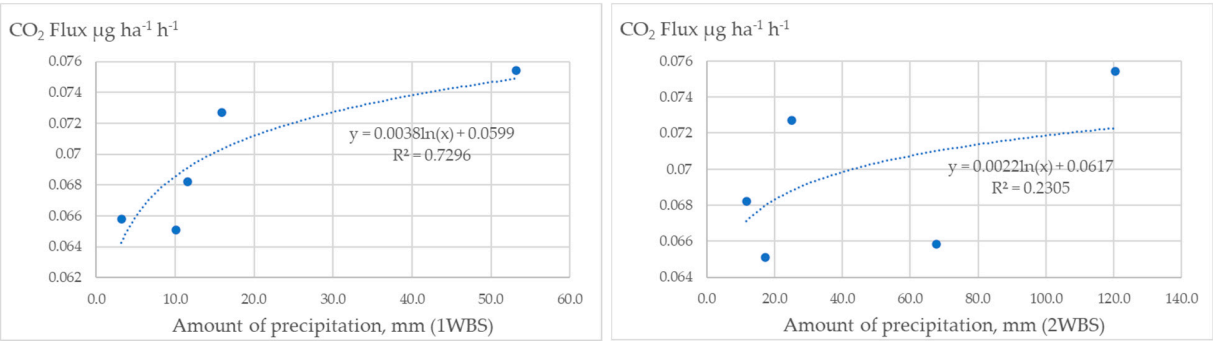
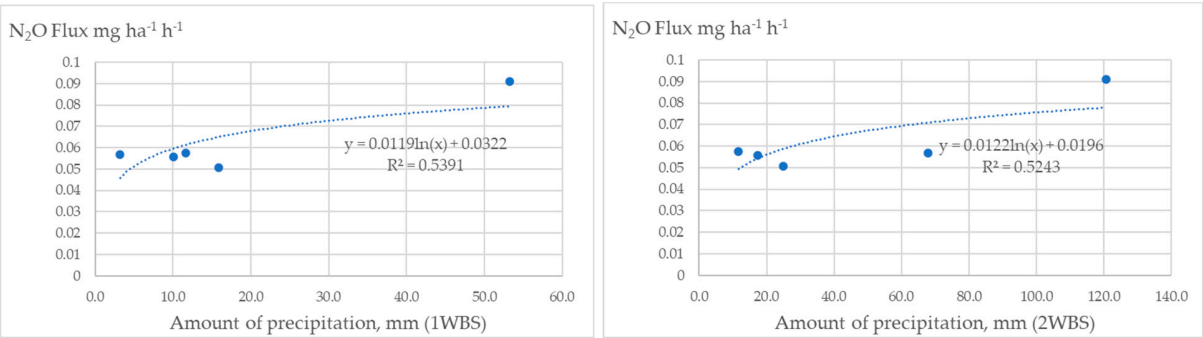


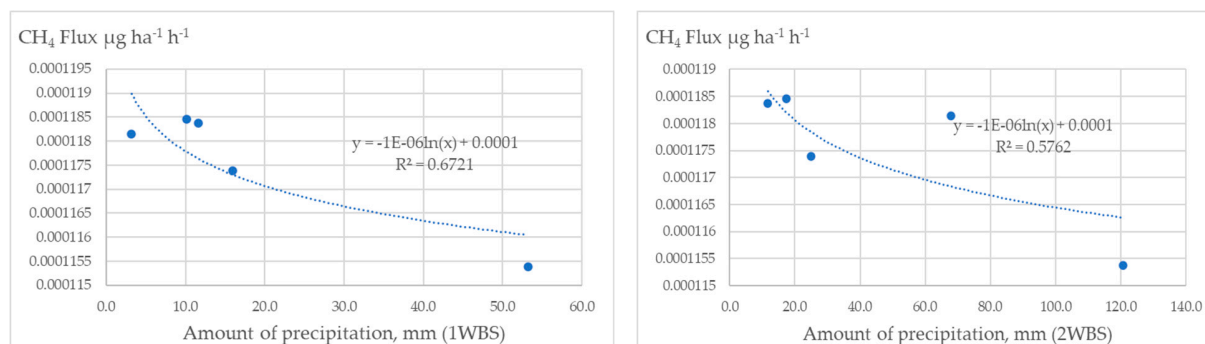
Supplemental figure S1. Meteorological conditions for the year 2023



(a)



(b)



(c)

Supplemental figure S2. Correlation coefficients used to investigate relationships between precipitation with (a) CO<sub>2</sub>, (b) N<sub>2</sub>O and (c) CH<sub>4</sub>. 1WBS (1 week before sampling), 2WBS (2 week before sampling)

Supplemental Table S1. The cumulative fluxes of CO<sub>2</sub>, CH<sub>4</sub> and N<sub>2</sub>O fluxes and the total global warming potential (GWP) expressed as 100-year time frame assessed as CO<sub>2</sub>-equivalent emissions.

	Cumulative mg CO <sub>2</sub> ha <sup>-1</sup>	Cumulative $\mu\text{g N}_2\text{O ha}^{-1}$	Cumulative $\mu\text{g CH}_4 \text{ ha}^{-1}$	Total GWP kg CO <sub>2</sub> eq. ha <sup>-1</sup> y <sup>-1</sup>
1	8.67	8.07	0.014	1.269bc
1G	8.41	6.89	0.014	1.085bc
1T	8.60	6.47	0.014	1.019c
1TG	8.57	8.90	0.014	1.571ab
3	8.21	10.09	0.014	1.808a
3G	8.68	8.22	0.014	1.432abc
3T	8.02	6.88	0.0148	1.082bc
3TG	8.26	7.43	0.014	1.169bc
5	7.89	6.49	0.014	1.021c
5G	8.71	6.61	0.014	1.040c
5T	8.17	6.99	0.0141	1.101bc
5TG	8.39	6.44	0.0141	1.014c

1-(+ploughing, -CC, -G), 1G-(ploughing, -CC, +G), 1T-(ploughing, +CC, -G), 1TG - (ploughing, +CC, +G); 3-(harrowing, -CC, -G), 3G-(harrowing, -CC, +G), 3T-(harrowing, +CC, -G), 3TG-(harrowing, +CC, +G), 5-(No till, -CC, -G), 5G-(No till, -CC, +G), 5T-(No till, +CC, -G), 5TG (No till, +CC, +G). Note: CC- cover crops, G-glyphosate, - negative, + positive. different letters in each treatment factor correspond to significant differences ( $p < 0.05$ ) between means according to Tukey's test, GWP- Global warming potential, CO<sub>2</sub>-Carbon dioxide, N<sub>2</sub>O- nitrous oxide, CH<sub>4</sub>-methane.

Supplementary Table S2. The anova table for the soil physical parameters

a) Anova table for soil volumetric water content (VWC)

	DF	Sum sq. mean	Mean Sq.	F value	Pr (>F)
Tillage	2	13.83	6.91	1.709	0.20
Cover crop	1	54.86	54.86	13.56	0.001*
Glyphosate	1	4.35	4.35	1.07	0.30
Tillage: Cover Crop	2	6.43	3.21	0.79	0.46
Tillage: Glyphosate	2	1.20	0.60	0.14	0.86
Cover Crop: Glyphosate	1	6.79	6.79	1.68	0.20
Tillage: Cover Crop: Glyphosate	2	9.44	2.22	0.54	0.58
Residuals	24	97.04	4.04		

\*Indicates statistically significant difference at  $p < 0.05$  according to Tukey's test, DF-degree of freedom, Pr value-the probability, Mean Sq- Mean square, Sum sq mean- mean of sum square,

b) Anova table for soil electrical conductivity (EC)

	DF	Sum sq. mean	Mean Sq.	F value	Pr (>F)
Tillage	2	35.41	17.10	4.33	0.02*
Cover crop	1	38.98	39.98	9.55	0.01*
Glyphosate	1	7.31	7.31	1.79	0.19
Tillage: Cover Crop	2	5.08	2.54	0.62	0.54
Tillage: Glyphosate	2	1.51	0.75	0.185	0.83
Cover Crop: Glyphosate	1	11.47	11.47	2.81	0.11
Tillage: Cover Crop: Glyphosate	2	8.16	4.08	1.00	0.38
Residuals	24	97.93	4.08		

\*Indicates statistically significant difference at  $p < 0.05$  according to Tukey's test, DF-degree of freedom, Pr value-the probability, Mean Sq- Mean square, Sum sq mean- mean of sum square,

c) Anova table for Water-filled pore space (WFPS)

	DF	Sum sq. mean	Mean Sq.	F value	Pr (>F)
Tillage	2	76.3	38.17	1.71	0.20
Cover crop	1	302.5	302.47	13.5	0.001*
Glyphosate	1	23.9	23.90	1.07	0.31
Tillage: Cover Crop	2	35.5	17.73	0.79	0.46
Tillage: Glyphosate	2	6.6	3.30	0.14	0.86
Cover Crop: Glyphosate	1	37.5	37.52	1.68	0.20
Tillage: Cover Crop: Glyphosate	2	24.5	12.24	0.54	0.58
Residuals	24	535.4	22.31		

\*Indicates statistically significant difference at  $p < 0.05$  according to Tukey's test, DF-degree of freedom, Pr value-the probability, Mean Sq- Mean square, Sum sq mean- mean of sum square,

d) Anova table for soil temperature

	DF	Sum sq. mean	Mean Sq.	F value	Pr (>F)
Tillage	2	7.92	3.96	5.54	0.01*
Cover crop	1	7.38	7.38	10.33	0.003*
Glyphosate	1	0.89	0.89	1.25	0.27
Tillage: Cover Crop	2	2.40	1.20	1.68	0.20
Tillage: Glyphosate	2	1.00	0.50	0.70	0.5
Cover Crop: Glyphosate	1	1.30	1.30	1.83	1.88
Tillage: Cover Crop: Glyphosate	2	1.64	0.82	1.15	0.33
Residuals	24	17.14	0.71		

\*Indicates statistically significant difference at  $p < 0.05$  according to Tukey's test, DF-degree of freedom, Pr value-the probability, Mean Sq- Mean square, Sum sq mean- mean of sum square,

e) Anova table for bulk density (BD)

	DF	Sum sq. mean	Mean Sq.	F value	Pr (>F)
Tillage	2	0.040	0.020	24.17	0.001*
Cover crop	1	0.000	0.000	0.48	0.49
Glyphosate	1	0.000	0.000	0.00	.00
Tillage: Cover Crop	2	0.005	0.0025	3.02	0.06
Tillage: Glyphosate	2	0.00	0.0000	0.00	1.00
Cover Crop: Glyphosate	1	0.000	0.0000	0.00	1.00
Tillage: Cover Crop: Glyphosate	2	0.000	0.0000	0.00	.00
Residuals	24	0.0198	0.0008		

\*Indicates statistically significant difference at  $p < 0.05$  according to Tukey's test, DF-degree of freedom, Pr value-the probability, Mean Sq- Mean square, Sum sq mean- mean of sum square,

f) Anova table for soil water-stable aggregates (WSA)

	DF	Sum sq. mean	Mean Sq.	F value	Pr (>F)
Tillage	2	737.10	368.60	24.64	0.0015*
Cover crop	1	95.70	95.70	6.40	0.018*
Glyphosate	1	0.00	0.00	0.00	.00
Tillage: Cover Crop	2	24.60	12.30	0.82	0.45
Tillage: Glyphosate	2	0.00	0.00	0.00	1.00
Cover Crop: Glyphosate	1	0.00	0.00	0.00	1.00
Tillage: Cover Crop: Glyphosate	2	0.00	0.00	0.00	1.00
Residuals	24	35.89	15.00		

\*Indicates statistically significant difference at  $p < 0.05$  according to Tukey's test, DF-degree of freedom, Pr value-the probability, Mean Sq- Mean square, Sum sq mean- mean of sum square,

g) Anova table for soil total porosity (TP)

	DF	Sum sq. mean	Mean Sq.	F value	Pr (>F)
Tillage	2	0.006	0.003	30.11	0.002*
Cover crop	1	0.001	0.000	1.77	0.19
Glyphosate	1	0.000	0.000	0.00	1.0
Tillage: Cover Crop	2	0.000	0.000	3.44	0.040*
Tillage: Glyphosate	2	0.000	0.000	0.00	1.0
Cover Crop: Glyphosate	1	0.000	0.000	0.00	1.0
Tillage: Cover Crop: Glyphosate	2	0.000	0.000	0.000	1.0
Residuals	24	0.002	0.000		

\*Indicates statistically significant difference at  $p < 0.05$  according to Tukey's test, DF-degree of freedom, Pr value-the probability, Mean Sq- Mean square, Sum sq mean- mean of sum square,