Supplementary Materials

Table S1. Average seasonal and annual variations of soil CO_2 emissions, soil temperature and soil water-filled pore space (WFPS) of the top soil (0–15 cm) for the five treatments over the 2-year from 2016–2018.

Parameters	Treatments	Wheat Season					Maize Season					Annual				
		Max	Min	Mean	± SE	CV (%)	Max	Min	Mean	± SE	CV (%)	Max	Min	Mean	± SE	CV (%)
Soil CO_2 emissions	OM	170.73	11.99	45.37	4.19	64.21	429.06	48.31	134.05	10.95	50.69	429.06	11.99	85.43	7.26	78.34
	CR	103.73	13.01	44.14	3.32	53.07	200.73	41.60	101.15	6.25	38.39	200.73	13.01	69.93	4.57	60.48
	NPK	47.66	5.16	24.11	1.49	42.72	143.31	29.60	67.22	4.41	40.72	143.31	5.16	43.57	3.17	67.33
	OMNPK	134.06	8.49	36.00	3.15	60.98	205.24	37.90	91.78	5.69	38.64	205.24	8.49	61.22	4.34	65.36
	CRNPK	128.29	15.99	54.45	3.65	46.53	192.94	38.70	100.27	6.27	39.11	192.94	15.99	75.26	4.31	52.92
Soil temperature (°C)	OM	24.38	4.65	15.56	0.65	33.47	28.85	17.85	24.98	0.42	10.35	28.85	4.65	18.28	0.76	38.20
	CR	25.33	4.80	16.05	0.65	32.57	29.35	17.70	24.95	0.43	10.70	29.35	4.80	18.62	0.74	36.60
	NPK	24.85	4.48	15.77	0.64	32.72	28.60	17.55	24.79	0.43	10.66	28.60	4.48	18.39	0.74	37.05
	OMNPK	24.55	4.73	15.72	0.64	32.87	28.80	17.80	24.82	0.41	10.18	28.80	4.73	18.31	0.74	37.12
	CRNPK	24.73	5.40	15.91	0.63	32.00	28.50	17.60	24.82	0.41	10.23	28.50	5.40	18.47	0.73	36.30
WFPS (%)	OM	62.11	14.74	33.68	1.40	34.97	73.27	11.65	35.00	2.72	48.31	74.71	11.65	33.18	1.50	42.05
	CR	65.94	18.31	34.64	1.41	35.07	77.16	15.99	36.88	2.66	44.74	77.16	15.48	34.40	1.49	40.85
	NPK	66.72	14.98	35.03	1.50	35.64	75.64	12.67	37.16	2.84	47.44	75.64	12.67	34.77	1.58	41.99
	OMNPK	67.11	16.98	35.50	1.44	33.93	79.89	13.49	37.33	2.82	47.17	81.47	13.31	35.03	1.57	41.50
	CRNPK	61.83	15.20	33.70	1.31	33.36	78.27	12.14	34.74	2.69	48.00	78.27	12.14	33.22	1.47	41.24

Max: maximum, Min: minimum, Mean: average, SE: standard errors, CV: coefficient of variation. Pig manure (OM), crop residues (CR), mineral fertilizer (NPK), combined pig manure and mineral fertilizer (OMNPK), and combined crop residues and mineral fertilizer (CRNPK).

Table S2. Seasonal and annual grain C uptake (g C m^{-2}), shoot C uptake (g C m^{-2}), and root C uptake (g C m^{-2}) for the five treatments over the two year from 2016–2018.

Year	Treatments	Wheat Season			Maize Season			Annual		
		Grain C Uptake	Shoot C Uptake	Root C Uptake	Grain C Uptake	Shoot C Uptake	Root C Uptake	Grain C Uptake	Shoot C Uptake	Root C Uptake
2016–2017										
	OM	116 ± 2.96ab	244 ± 29.35a	28 ± 4.89a	126 ± 15.02b	274 ± 23.65a	42 ± 1.61a	242 ± 14.53b	518 ± 43.03a	70 ± 6.66a
	CR	54 ± 1.73c	121 ± 7.97b	11 ± 1.27b	82 ± 1.98c	139 ± 14.03b	18 ± 2.10c	137 ± 0.33c	260 ± 10.81b	29 ± 2.08c
	NPK	96 ± 11.98b	211 ± 9.76a	21 ± 3.89ab	183 ± 15.17a	274 ± 39.23a	30 ± 1.62b	279 ± 16.92ab	484 ± 42.44a	51 ± 4.48b
	OMNPK	132 ± 4.58a	221 ± 11.20a	21 ± 3.23ab	183 ± 17.74a	267 ± 1.20a	29 ± 1.80b	315 ± 22.23a	487 ± 10.40a	51 ± 2.33b
	CRNPK	105 ± 4.82b	216 ± 9.40a	27 ± 0.45a	207 ± 9.54a	271 ± 18.48a	46 ± 1.74a	313 ± 13.32a	487 ± 9.33a	73 ± 2.40a
2017–2018										
	OM	189 ± 7.06a	140 ± 4.82a	39 ± 1.58b	250 ± 21.18a	200 ± 12.07a	58 ± 1.34a	439 ± 16.27a	340 ± 16.86a	97 ± 2.08a
	CR	74 ± 6.81c	66 ± 1.73c	22 ± 2.55b	172 ± 7.45b	133 ± 24.90b	29 ± 2.21b	246 ± 7.00c	199 ± 24.13c	50 ± 0.88c
	NPK	160 ± 6.76b	74 ± 2.57c	20 ± 0.56b	222 ± 21.74ab	143 ± 12.60ab	26 ± 4.47b	382 ± 27.65ab	217 ± 11.92c	46 ± 4.37c
	OMNPK	149 ± 2.94b	107 ± 15.31b	32 ± 1.45a	228 ± 9.61ab	173 ± 9.03ab	34 ± 1.89b	377 ± 9.64ab	280 ± 6.33b	66 ± 0.67b
	CRNPK	146 ± 7.65b	107 ± 4.27b	31 ± 4.87a	226 ± 20.21ab	193 ± 21.86a	32 ± 1.19b	373 ± 26.40b	299 ± 17.40ab	63 ± 5.36b
Mean (2016–2018)										
	OM	153 ± 2.52a	192 ± 17.04a	34 ± 3.28a	188 ± 12.20a	237 ± 14.59a	50 ± 1.15a	341 ± 12.57a	429 ± 28.62a	84 ± 4.18a
	CR	64 ± 3.46d	93 ± 3.67c	17 ± 1.20c	127 ± 2.96b	136 ± 11.00b	23 ± 0.58d	191 ± 3.53b	230 ± 13.32c	40 ± 1.76d
	NPK	128 ± 5.69c	142 ± 4.41b	20 ± 1.45bc	202 ± 17.99a	208 ± 14.11a	28 ± 2.96c	331 ± 21.67a	350 ± 16.02b	48 ± 3.84d
	OMNPK	141 ± 2.33b	164 ± 12.99ab	27 ± 2.19ab	205 ± 4.16a	220 ± 5.09a	32 ± 1.73c	346 ± 6.39a	384 ± 8.17ab	58 ± 0.88c
	CRNPK	126 ± 1.53c	162 ± 5.55ab	29 ± 2.52a	217 ± 5.41a	232 ± 14.78a	39 ± 0.58b	343 ± 6.64a	393 ± 9.74ab	68 ± 3.28b

Mean ± SE: Means in columns followed by different lower cases letter are significantly different (LSD, $P < 0.05$) and means followed by the same lower cases letter are not significantly different (LSD, $P < 0.05$). Pig slurry as organic manure (OM), Crop residues (CR), Mineral fertilizer (NPK), combined organic manure with mineral fertilizers (OMNPK), and combined crop residues with mineral fertilizers (CRNPK).

Table S3. Carbon contents (%) of grain, shoot biomass and root biomass of wheat and maize for the five treatments over the 2-year from 2016–2018.

Treatments	Wheat Season			Maize Season		
	Grain (%)	Shoot Biomass (%)	Root Biomass (%)	Grain (%)	Shoot Biomass (%)	Root Biomass (%)
2016–2017						
OM	42.15 ± 0.07a	42.71 ± 0.58ab	40.15 ± 0.84a	42.35 ± 0.02a	41.78 ± 0.30a	36.87 ± 0.75a
CR	41.95 ± 0.13a	42.01 ± 0.10b	37.06 ± 0.69a	42.88 ± 0.34a	40.55 ± 0.32b	39.87 ± 0.59a
NPK	42.05 ± 0.21a	43.95 ± 0.14a	31.23 ± 2.23b	42.49 ± 0.10a	42.14 ± 0.19a	39.74 ± 1.42a
OMNPK	42.06 ± 0.14a	43.41 ± 0.17a	35.57 ± 0.66ab	42.51 ± 0.05a	41.97 ± 0.12a	36.57 ± 0.92a
CRNPK	42.06 ± 0.22a	42.96 ± 0.28ab	35.83 ± 0.86ab	42.40 ± 0.22a	41.59 ± 0.35a	38.57 ± 1.40a
2017–2018						
OM	40.94 ± 0.03ab	41.49 ± 1.02a	37.13 ± 0.50a	43.21 ± 0.18a	43.00 ± 0.21a	45.66 ± 0.26a
CR	41.24 ± 0.08a	41.63 ± 1.36a	37.00 ± 1.14a	43.14 ± 0.02a	43.15 ± 0.51a	44.81 ± 0.80a
NPK	41.37 ± 0.12a	40.97 ± 2.49a	37.46 ± 0.74a	43.23 ± 0.16a	43.30 ± 0.36a	45.64 ± 0.09a
OMNPK	40.50 ± 0.18b	42.00 ± 0.86a	36.80 ± 0.55a	43.19 ± 0.21a	42.70 ± 0.34a	45.67 ± 0.45a
CRNPK	41.11 ± 0.23a	42.28 ± 0.22a	36.54 ± 1.94a	43.05 ± 0.18a	43.01 ± 0.81a	43.97 ± 1.52a

Mean ± SE: Means in columns followed by different lower cases letter are significantly different (LSD, $p < 0.05$) and means followed by the same lower cases letter are not significantly different (LSD, $p < 0.05$). Pig manure (OM), crop residues (CR), mineral fertilizer (NPK), combined pig manure and mineral fertilizer (OMNPK), and combined crop residues and mineral fertilizer (CRNPK).

Table S4. Mean sediment C content, soil sediment loss for the five treatments over the 2-year of 2017 and 2018 during the maize growing season.

Treatments	Sediment C Content (%)	Sediment loss in 2017 (g Cm^{-2})	Sediment loss in 2018 (g m^{-2})
OM	1.64 ± 0.25bc	15.68 ± 4.01a	44.64 ± 5.70a
CR	2.29 ± 0.05a	6.08 ± 1.76a	8.59 ± 0.77b
NPK	1.55 ± 0.15bc	21.01 ± 6.33a	46.42 ± 10.99a
OMNPK	1.52 ± 0.07c	17.18 ± 6.97a	47.22 ± 10.75a
CRNPK	1.99 ± 0.04ab	10.98 ± 2.79a	18.51 ± 7.23b

Mean ± SE: Means in columns followed by different lower cases letter are significantly different (LSD, $p < 0.05$) and means followed by the same lower cases letter are not significantly different (LSD, $p < 0.05$). Pig manure (OM), crop residues (CR), mineral fertilizer (NPK), combined pig manure and mineral fertilizer (OMNPK), and combined crop residues and mineral fertilizer (CRNPK). LDS, least significant difference.

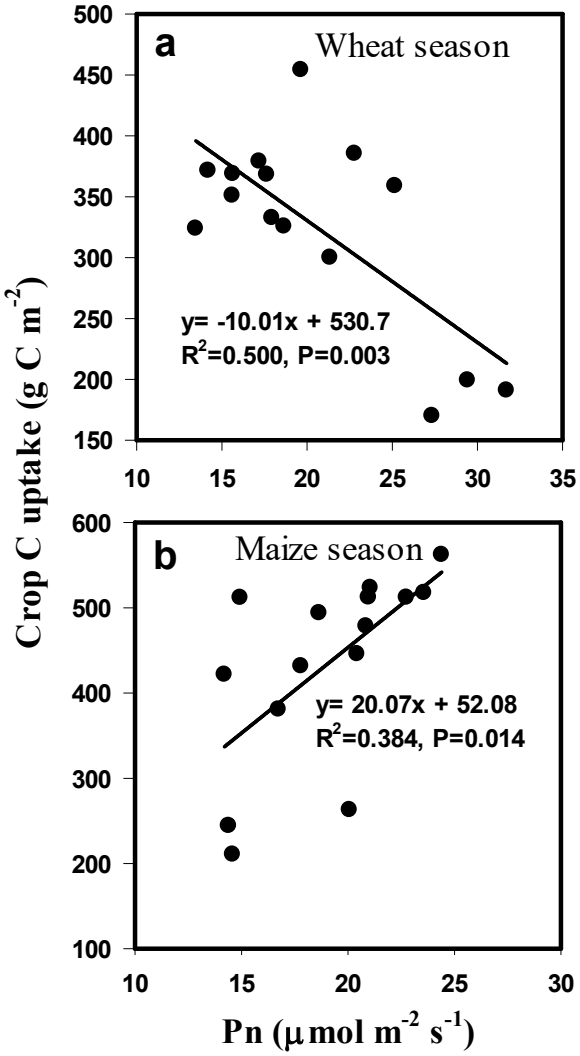

Figure S1. Relationships between crop C uptake and leaf photosynthesis rate (Pn) in the wheat season (a) and crop C uptake and leaf photosynthesis in the maize season (b) across the five treatments in 2016–2017.

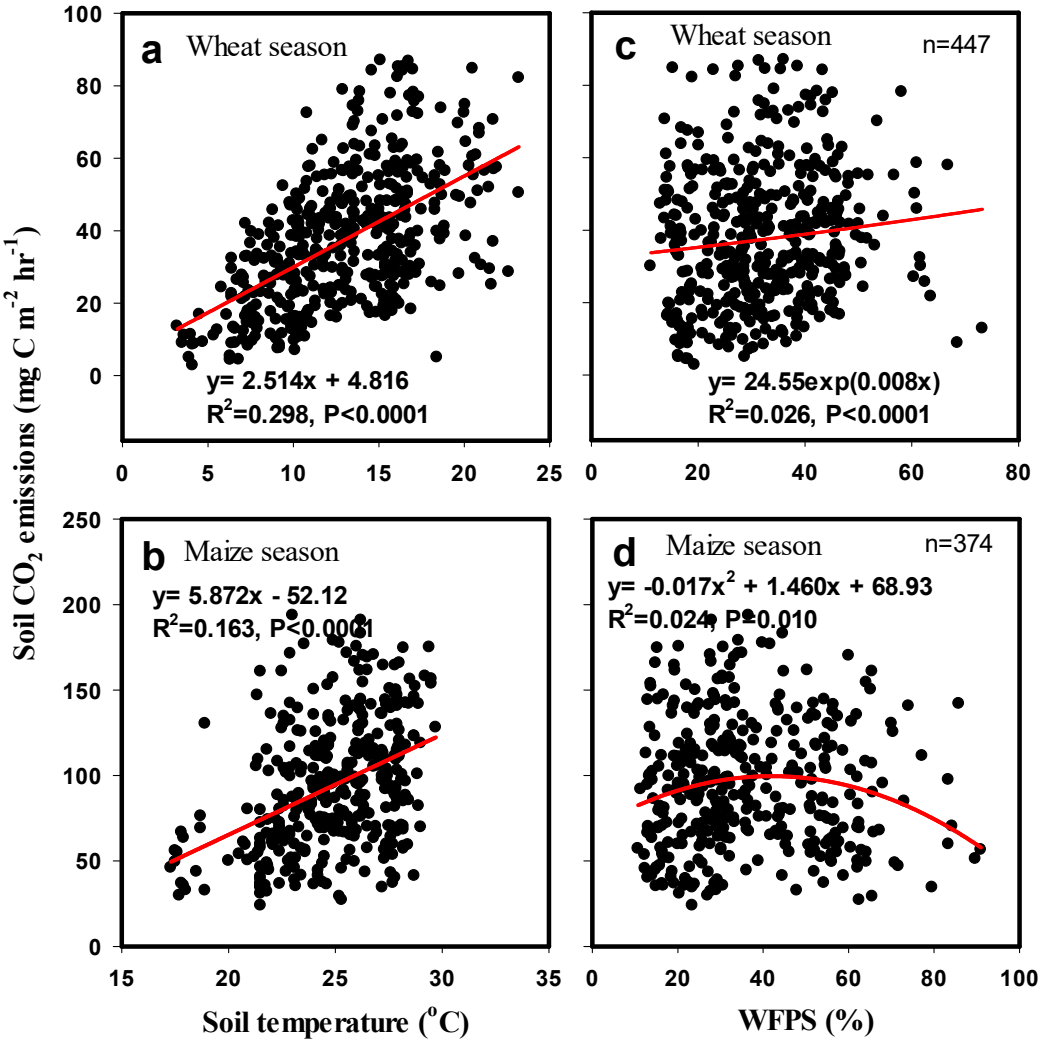

Figure S2. Relationships between the wheat and the maize season's soil CO_2 emissions and soil temperature in the wheat (a–b), the wheat and the maize season's soil CO_2 emissions and the soil water-filled pore space (WFPS) (c–d) across the five treatments over 2-year experiments of 2016–2018.

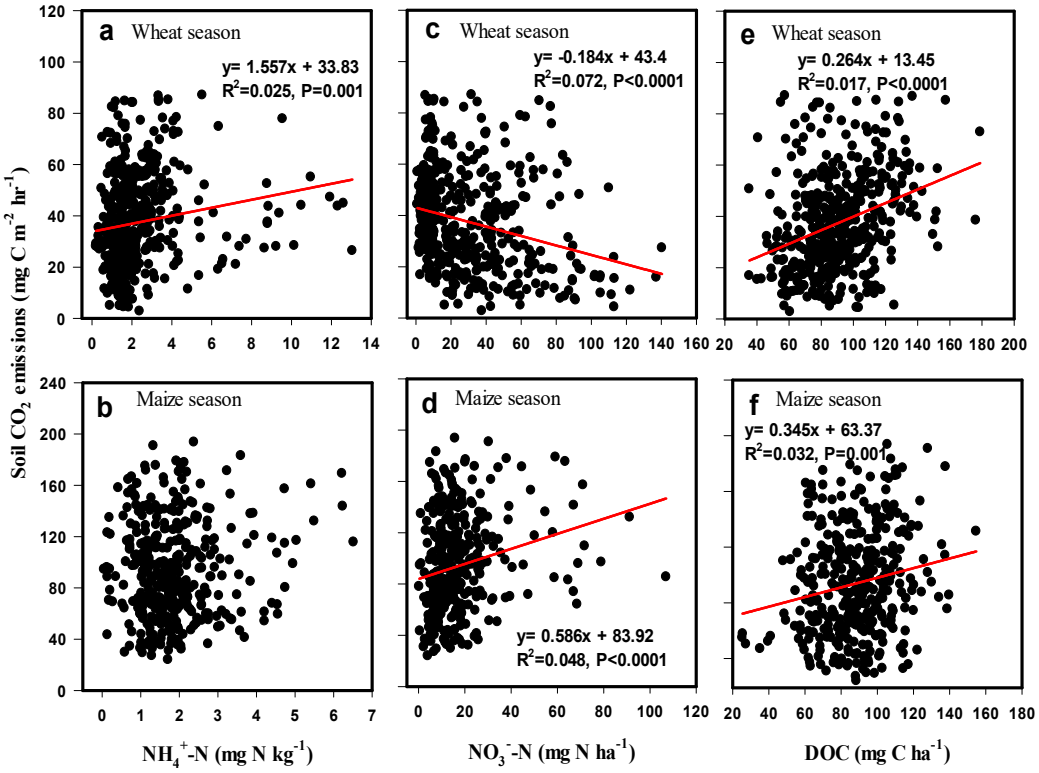

Figure S3. Relationships between wheat and maize seasons soil CO_2 emissions and soil ammonia nitrogen (NH_4^+-N) (a–b), wheat and maize seasons soil CO_2 emissions and nitrate nitrogen (NO_3^--N) (c–d) and wheat and maize seasons soil CO_2 emissions and dissolved organic carbon (DOC) (e–f) across the five treatments.

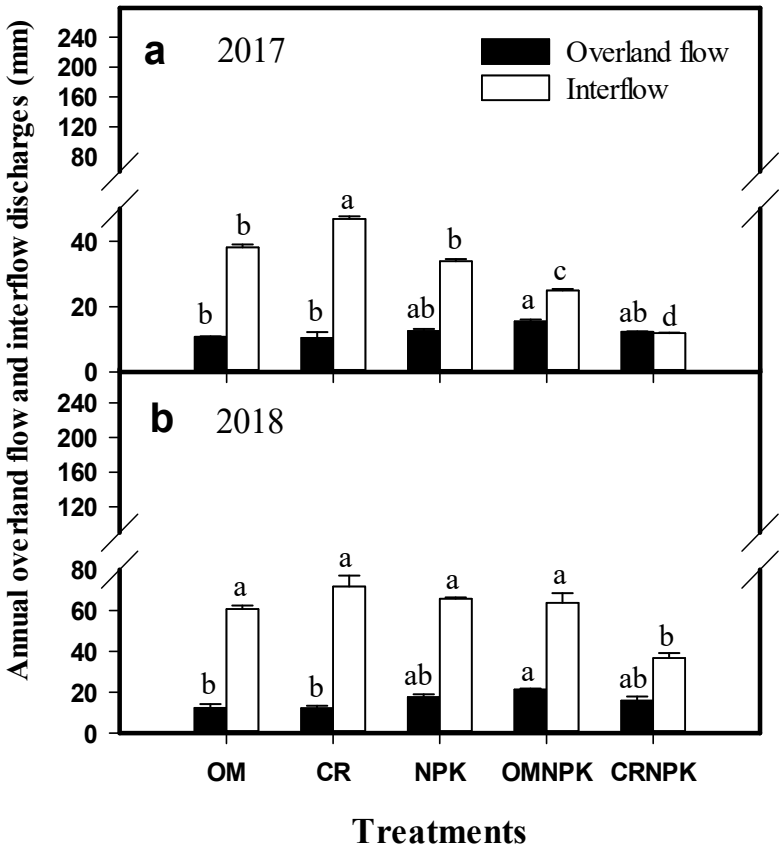

Figure S4. Annual discharges of runoff water from the overland flow and the interflow from the five treatments over the two year experiment of 2017 and 2018. The vertical bars indicate the standard error of the three spatial replicates (n = 3).