

Table S1. Percent Organic Carbon Mixed Model Results.

Fixed Effects	Estimate	Standard Error	<i>t</i>	<i>p</i>
NT	1.25	0.08	15.16	<0.01
RT	1.03	0.08	12.51	<0.01
RC	0.01	0.11	0.08	0.94
RY	-0.01	0.11	-0.08	0.94
July	-0.04	0.11	-0.40	0.69
June	-0.10	0.11	-0.92	0.36
May	0.10	0.11	0.97	0.33
Sept	-0.15	0.11	-1.39	0.17
2020	-0.07	0.11	-0.65	0.52
RTxRC	0.09	0.15	0.60	0.55
RTxRY	0.06	0.15	0.40	0.69
RTxJuly	-0.09	0.15	-0.60	0.55
RTxJune	0.15	0.15	1.01	0.32
RTxMay	-0.15	0.15	-0.99	0.32
RTxSept	0.11	0.15	0.72	0.47
RCxJuly	-0.06	0.15	-0.41	0.69
RYxJuly	-0.03	0.15	-0.17	0.87
RCxJune	0.07	0.15	0.46	0.65
RYxJune	0.12	0.15	0.79	0.43
RCxMay	0.03	0.15	0.21	0.83
RYxMay	0.08	0.15	0.55	0.58
RCxSept	0.33	0.15	2.17	0.03
RYxSept	0.28	0.15	1.87	0.06*
RTx2020	0.02	0.15	0.12	0.90
RCx2020	0.09	0.15	0.57	0.57
RYx2020	0.05	0.15	0.32	0.75
Julyx2020	0.07	0.15	0.48	0.63
Junex2020	0.20	0.15	1.32	0.19
Mayx2020	-0.09	0.15	-0.62	0.54
Setpx2020	0.10	0.15	0.64	0.52
RTxRCxJuly	0.24	0.21	1.12	0.26
RTxRYxJuly	0.11	0.21	0.53	0.60
RTxRCxJune	0.05	0.21	0.24	0.81
RTxRYxJune	-0.08	0.21	-0.36	0.72
RTxRCxMay	0.13	0.21	0.62	0.54
RTxRYxMay	0.06	0.21	0.30	0.77
RTxRCxSept	-0.24	0.21	-1.14	0.26
RTxRYxSept	-0.14	0.21	-0.66	0.51
RTxRCx2020	-0.12	0.21	-0.58	0.56
RTxRYx2020	0.16	0.21	0.74	0.46
RTxJunex2020	-0.22	0.21	-1.01	0.32
RTxMayx2020	0.19	0.21	0.90	0.37
RTxSeptx2020	-0.04	0.21	-0.20	0.84
RCxJulyx2020	0.26	0.21	1.24	0.22
RYxJulyx2020	0.10	0.21	0.45	0.66
RCxJunex2020	0.01	0.21	0.03	0.97

RYxJunex2020	-0.13	0.21	-0.59	0.56
RCxMayx2020	-0.26	0.21	-1.21	0.23
RYxMayx2020	-0.13	0.21	-0.61	0.54
RCxSeptx2020	-0.22	0.21	-1.05	0.30
RYxSeptx2020	-0.20	0.21	-0.95	0.34
RTxRCxJulyx2020	-0.57	0.30	-1.89	0.06*
RTxRYxJulyx2020	-0.32	0.30	-1.05	0.30
RTxRCxJunex2020	-0.12	0.30	-0.40	0.69
RTxRYxJunex2020	0.10	0.30	0.32	0.75
RTxRCxMayx2020	0.00	0.30	0.00	1.00
RTxRYxMayx2020	-0.17	0.30	-0.57	0.57
RTxRCxSeptx2020	0.18	0.30	0.58	0.56
RTxRYxSeptx2020	-0.01	0.30	-0.02	0.98
Random Effect	sd			
Block	0.06			

P-values were estimated via t-tests using the Satterthwaite approximations to degrees of freedom. Bolded values indicate a significant effect. Asterisk indicate suggested effect.

Table S2. Mixed Model Results of Soil Environmental Variables Relationship with %OC and CO₂ Flux.

Response	Fixed Effect	Estimate	Standard Error.	<i>t</i>	<i>p</i>
%OC	Bacterial Abundance	0.04	0.01	3.32	<0.01
	pH	-0.05	0.01	-4.54	<0.01
	Soil Temperature	0.01	0.01	0.66	0.51
	Random Effect	sd			
	Block	1.18			
CO ₂ Flux	Bacterial Abundance	-15.23	5.86	-2.59	0.01
	pH	-15.15	6.09	-2.49	0.01
	Soil Temperature	6.1	5.83	1.05	0.30
	Random Effect	sd			
	Block	446.1			

P-values were estimated via t-tests using the Satterthwaite approximations to degrees of freedom. Bolded values indicate a significant effect. Asterisk indicate a marginal effect.

Table S3. CO₂ Flux Mixed Model Results.

Fixed Effects	Estimate	Standard Error	<i>t</i>	<i>p</i>
NT	509.90	35.18	14.49	<0.01
RT	501.58	35.18	14.26	<0.01
RC	47.77	49.56	0.96	0.34
RY	1.38	49.56	0.03	0.98
July	-79.37	49.56	-1.60	0.11*
June	-84.74	49.56	-1.71	0.09*
May	-99.19	49.56	-2.00	0.05
Sept	-145.80	49.56	-2.94	<0.01
2020	-92.81	49.56	-1.87	0.06*
RTxRC	2.58	70.09	0.04	0.97
RTxRY	101.98	70.09	1.46	0.15
RTxJuly	2.34	70.09	0.03	0.97
RTxSept	-74.45	70.09	-1.06	0.29
RCxJuly	-60.91	70.09	-0.87	0.39
RYxJuly	0.73	70.09	0.01	0.99
RCxJune	-55.69	70.09	-0.80	0.43
RYxJune	-3.66	70.09	-0.05	0.96
RCxMay	-38.91	70.09	-0.56	0.58
RYxMay	20.71	70.09	0.30	0.77
RCxSept	-92.04	70.09	-1.31	0.19
RYxSept	-39.42	70.09	-0.56	0.57
RTx2020	13.85	70.09	0.20	0.84
RCx2020	-11.86	70.09	-0.17	0.87
RYx2020	17.65	70.09	0.25	0.80
Julyx2020	119.82	70.09	1.71	0.09*
Junex2020	101.54	70.09	1.45	0.15
Mayx2020	126.61	70.09	1.81	0.07*
Setpx2020	169.21	70.09	2.41	0.02
RTxRCxJuly	30.45	99.13	0.31	0.76
RTxRYxJuly	-102.98	99.13	-1.04	0.30
RTxRCxJune	6.50	99.13	0.07	0.95
RTxRYxJune	-98.26	99.13	-0.99	0.32
RTxRCxMay	-10.03	99.13	-0.10	0.92
RTxRYxMay	-118.96	99.13	-1.20	0.23
RTxRCxSept	8.79	99.13	0.09	0.93
RTxRYxSept	-18.92	99.13	-0.19	0.85
RTxRCx2020	9.23	99.13	0.09	0.93
RTxRYx2020	-64.11	99.13	-0.65	0.52
RTxJulyx2020	121.92	99.13	1.23	0.22
RTxJunex2020	-10.64	99.13	-0.11	0.91
RTxMayx2020	-24.22	99.13	-0.24	0.81
RTxSeptx2020	67.86	99.13	0.69	0.49
RCxJulyx2020	70.98	99.13	0.72	0.47
RYxJulyx2020	118.43	99.13	1.20	0.23
RCxJunex2020	15.57	99.13	0.16	0.88

RYxJunex2020	25.91	99.13	0.26	0.79
RCxMayx2020	6.38	99.13	0.06	0.95
RYxMayx2020	-38.67	99.13	-0.39	0.70
RCxSeptx2020	57.57	99.13	0.58	0.56
RYxSeptx2020	23.51	99.13	0.24	0.81
RTxRCxJulyx2020	-103.32	140.19	-0.74	0.46
RTxRYxJulyx2020	-46.57	140.19	-0.33	0.74
RTxRYxJunex2020	36.23	140.19	0.26	0.80
RTxRCxMayx2020	-4.35	140.19	-0.03	0.98
RTxRYxMayx2020	81.04	140.19	0.58	0.56
RTxRCxSeptx2020	-5.72	140.19	-0.04	0.97
RTxRYxSeptx2020	-22.33	140.19	-0.16	0.87
Random Effect	sd			
Block	6.13			

P-values were estimated via t-tests using the Satterthwaite approximations to degrees of freedom. Bolded values indicate a significant effect. Asterisk indicate suggested effect.

Table S4. Cover Crop Biomass Mixed Model Results.

Fixed Effect	Estimate	Standard Error	<i>t</i>	<i>p</i>
NT	-108500.00	101000.00	-1.07	0.29
RT	-60550.00	101000.00	-0.60	0.55
RC	608800.00	142900.00	4.26	<0.01
RY	465200.00	142900.00	3.26	<0.01
May	-16030.00	142900.00	-0.11	0.91
Sept	16030.00	142900.00	0.11	0.91
Year	53.77	50.04	1.08	0.29
RTxRC	-207100.00	202100.00	-1.03	0.31
RTxRY	-75330.00	202100.00	-0.37	0.71
RTxMay	19270.00	202100.00	0.10	0.92
RTxSept	-19270.00	202100.00	-0.10	0.92
RCxMay	340500.00	202100.00	1.69	0.10*
RYxMay	222100.00	202100.00	1.10	0.27
RCxSept	-340500.00	202100.00	-1.69	0.09*
RYxSept	-222100.00	202100.00	-1.10	0.27
RTxYear	-23.73	70.76	-0.34	0.74
RCxYear	-301.30	70.76	-4.26	<0.01
RYxYear	-230.30	70.76	-3.25	<0.01
MayxYear	7.96	70.76	0.11	0.91
SeptxYear	-7.96	70.76	-0.11	0.91
RTxRCxMay	-97810.00	285800.00	-0.34	0.73
RTxRYxMay	-64070.00	285800.00	-0.22	0.82
RTxRCxSept	97810.00	285800.00	0.34	0.73
RTxRYxSept	64070.00	285800.00	0.22	0.82
RTxRCxYear	102.60	100.10	1.03	0.31
RTxRYxYear	37.29	100.10	0.37	0.71
RTxMayxYear	-9.55	100.10	-0.10	0.92
RTxSeptxYear	9.55	100.10	0.10	0.92
RCxMayxYear	-168.50	100.10	-1.68	0.10
RYxMayxYear	-109.90	100.10	-1.10	0.27
RCxSeptxYear	168.50	100.10	1.68	0.09*

RYxSeptxYear	109.90	100.10	1.10	0.27
RTxRCxMayxYear	48.44	141.50	0.34	0.73
RTxRYxMayxYear	31.72	141.50	0.22	0.82
RTxRCxSeptxYear	-48.44	141.50	-0.34	0.73
RTxRYxSeptxYear	-31.72	141.50	-0.22	0.82
Random Effect	sd			
Block	13.9			

P-values were estimated via t-tests using the Satterthwaite approximations to degrees of freedom. Bolded values indicate a significant effect. Asterisk indicate a marginal effect.

Table S5. %OC to CO₂ Flux Mixed Model Results.

Fixed Effect	Estimate	Standard Error	<i>t</i>	<i>p</i>
NT	0.98	0.15	6.74	<0.01
RT	0.48	0.15	3.33	0.01
RC	0.31	0.14	2.30	0.02
RY	0.16	0.14	1.19	0.24
RTxRC	-0.02	0.19	-0.08	0.94
RTxRY	0.23	0.19	1.18	0.24
Random Effect	sd			
Block	0.21			

P-values were estimated via t-tests using the Satterthwaite approximations to degrees of freedom. Bolded values indicate a significant effect

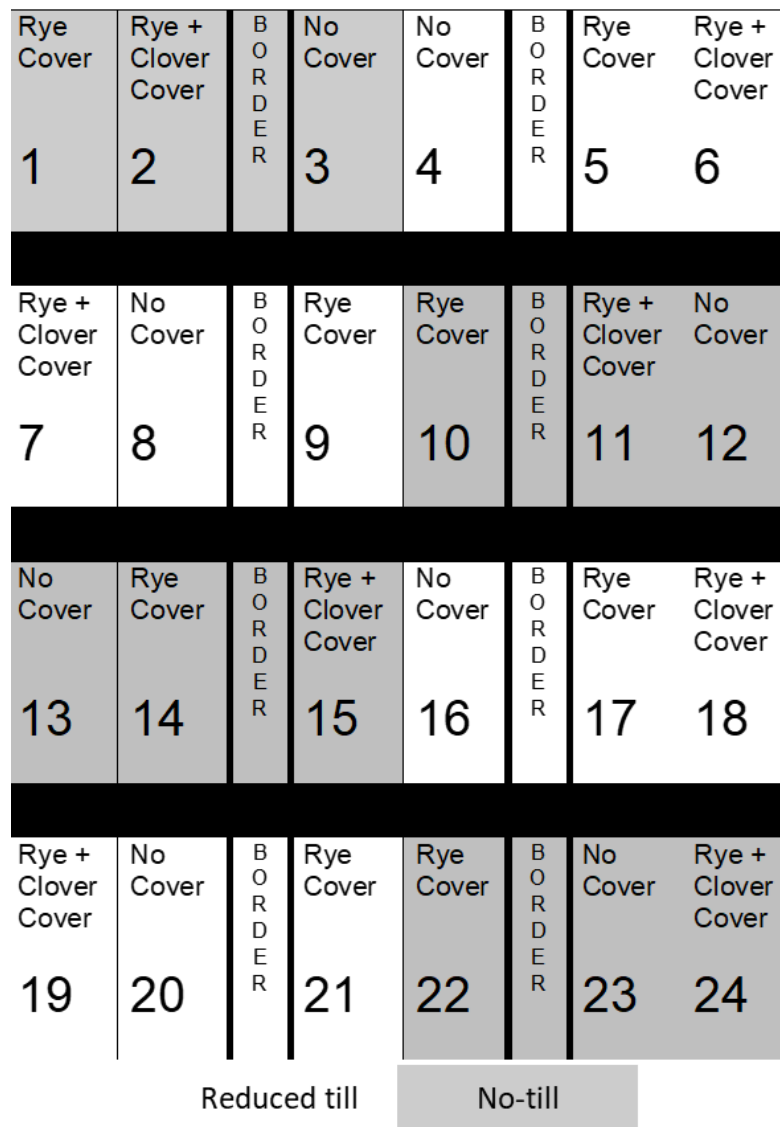


Figure S1. Treatment plot map, treatment plot layout of study in Stoneville, MS, USA. Plots were in a split-block design, each block separated by a solid black bar. Cover crop treatments (rye, rye + clover or no cover) were implemented on plots under a reduced till (white) or no-till regime (grey).