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Supplement of

Drivers of soil C quality and stability: insights from a topsoil dataset at landscape scale in Ontario, Canada

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10 **Table S1** Within each soil textural class, interactive effect of cropping system and tillage intensity
 11 treatment on the soil C indicators in the Ontario Topsoil Sampling Project from 2019 to 2022.

Soil textural class	Cropping system	n	Conventional	Moderate	Light	No	No-tillage
			tillage ^z	disturbance	disturbance	disturbance ^y	
			SOC (mg g ⁻¹)				
Coarse	Annual grain	163	17.7 (1.40) ^x	14.8 (1.20)	18.9 (1.00)	13.3 (3.10)	16.7 (2.00)
	Forage	52	19.4 (5.60)	19.4 (1.90)	20.4 (1.80)	17.3 (3.30)	16.8 (3.60)
Medium	Annual grain	307	20.6 (0.80)ab	21.2 (0.70)ab	20.8 (0.60)ab	23.2 (1.80)a	21.0 (1.10)ab
	Forage	129	20.9 (1.00)ab	21.0 (0.90)ab	20.5 (1.20)ab	21.8 (2.20)ab	16.6 (2.10)b
Fine	Annual grain	282	24.4 (1.20)ab	22.2 (0.90)ab	24.0 (0.80)ab	21.8 (2.30)ab	21.7 (1.10)b
	Forage	130	24.2 (1.40)ab	26.5 (1.30)a	26.1 (1.20)a	22.1 (3.70)ab	24.8 (2.50)ab
			C _{min} -96h (mg CO ₂ -C 20 g ⁻¹ soil)				
Coarse	Annual grain	107	12.8 (1.80)b	12.7 (1.41)b	15.9 (1.14)ab	15.0 (3.94)ab	12.5 (3.21)b
	Forage	34	14.0 (7.88)ab	21.6 (2.18)a	21.9 (2.37)a	18.2 (3.94)ab	14.5 (3.52)ab
Medium	Annual grain	225	19.7 (1.23)b	19.1 (0.92)b	20.7 (0.84)ab	22.8 (2.10)ab	20.2 (1.48)b
	Forage	83	23.7 (1.61)ab	22.9 (1.43)ab	21.4 (1.61)ab	25.5 (2.87)a	17.5 (3.79)b
Fine	Annual grain	170	20.0 (1.44)b	19.9 (1.04)b	22.2 (1.02)ab	20.6 (3.17)ab	21.4 (1.67)ab
	Forage	64	25.4 (2.45)a	26.0 (1.65)a	24.6 (1.58)a	27.6 (3.47)a	22.3 (4.48)ab
			POXC (µg g ⁻¹)				
Coarse	Annual grain	154	484 (30.4)ab	447 (23.7)ab	484 (20.9)ab	410 (60.9)b	478 (43.0)ab
	Forage	51	560 (113)ab	564 (39.0)a	563 (35.1)a	511 (65.7)ab	426 (72.0)ab
Medium	Annual grain	282	585 (20.3)a	573 (16.7)a	590 (13.9)a	626 (40.3)a	589 (24.9)a
	Forage	113	599 (24.9)a	620 (24.2)a	603 (28.5)a	617 (51.3)a	468 (48.4)b
Fine	Annual grain	272	620 (24.1)ab	582 (18.1)ab	600 (16.9)ab	536 (43.9)b	520 (21.7)b
	Forage	123	620 (27.5)ab	685 (27.9)a	657 (24.1)a	498 (70.8)b	579 (50.0)ab
			Solvita CO ₂ -burst (mg kg ⁻¹)				
Coarse	Annual grain	88	52.8 (6.75)b	58.2 (5.23)b	59.9 (4.55)b	41.2 (13.0)b	51.4 (7.88)b
	Forage	21	76.4 (26.1)ab	87.1 (8.71)a	70.8 (8.71)ab	67.7 (18.4)ab	--
Medium	Annual grain	142	59.3 (4.83)	71.4 (5.08)	69.0 (3.33)	69.5 (19.0)	81.5 (6.72)
	Forage	70	76.1 (5.61)	80.5 (5.73)	81.9 (6.94)	76.9 (13.4)	52.0 (10.9)
Fine	Annual grain	201	71.3 (4.67)c	69.7 (3.74)c	79.4 (3.44)bc	77.4 (9.35)bc	83.8 (3.67)bc
	Forage	80	88.7 (5.40)ab	82.9 (6.23)abc	88.9 (5.19)ab	119 (18.7)a	79.0 (8.36)ab
			ACE (mg kg ⁻¹)				
Coarse	Annual grain	22	8.76 (1.19)	5.76 (1.09)	6.08 (0.89)	--	8.09 (1.88)
	Forage	3	10.1 (2.67)	--	9.92 (2.67)	5.40 (2.67)	--
Medium	Annual grain	23	5.44 (1.17)ab	4.63 (0.82)b	5.59 (0.47)ab	5.55 (1.65)ab	6.67 (0.82)ab
	Forage	14	6.18 (0.82)ab	8.16 (0.82)a	6.02 (0.82)ab	5.89 (1.65)ab	5.35 (1.65)ab
Fine	Annual grain	49	5.70 (0.58)	5.41 (0.55)	6.18 (0.49)	2.55 (1.84)	--
	Forage	10	6.00 (1.06)	5.49 (1.84)	6.95 (0.82)	--	7.26 (1.84)

^zConventional tillage represents plow tillage in our study.

^yNo disturbance represented little to no soil movement and was associated mainly with pastures and perennial forages.

^xrepresents standard error of treatment means.

^{a-c}Within each soil textural class and for each parameter, treatment means followed by a different letter indicate statistical significance at $P < 0.05$.

SOC=soil organic carbon; C_{min}-96h= 96-hr carbon mineralization; POXC=permanganate oxidizable carbon; Solvita CO₂-burst= 24 h soil respiration test; and

ACE=autoclaved citrate extractable protein index; --=not applicable

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18 **Table S2** Within coarse-textured soil (n=29), interactive effect of cropping system and tillage intensity treatment
 19 on the programmed pyrolysis parameters analyzed in the Ontario Topsoil Sampling Project in 2019.

	Conventional tillage ^z	Moderate disturbance	Light disturbance	No disturbance ^y	No-tillage
Cropping system	Hydrogen Index (mg HC g⁻¹ OC)				
Annual grain	161 (13.5) ^x	138 (13.5)	151 (10.0)	--	164 (21.3)
Forage	158 (30.2)	--	182 (30.2)	151 (30.2)	--
Vegetable	--	169 (30.2)	156 (30.2)	--	--
Orchard	--	130 (30.2)	134 (30.2)	--	--
Perennial	--	--	--	--	--
	Oxygen Index (mg CO₂ g⁻¹ OC)				
Annual grain	158 (7.60)	161 (7.60)	180 (5.66)	--	162 (12.0)
Forage	218 (17.0)	--	209 (17.0)	195 (17.0)	--
Vegetable	--	139 (17.0)	156 (17.0)	--	--
Orchard	--	232 (17.0)	175 (17.0)	--	--
Perennial	--	--	--	--	--
	T50 (°C)				
Annual grain	414 (3.12)	415 (3.12)	418 (2.32)	--	416 (4.94)
Forage	420 (6.98)	--	411 (6.98)	406 (6.98)	--
Vegetable	--	405 (6.98)	425 (6.98)	--	--
Orchard	--	426 (6.98)	412 (6.98)	--	--
Perennial	--	--	--	--	--
	S1 (mg HC g⁻¹ rock)				
Annual grain	0.47 (0.07)	0.24 (0.07)	0.29 (0.05)	--	0.30 (0.12)
Forage	0.49 (0.17)	--	0.79 (0.17)	0.37 (0.17)	--
Vegetable	--	0.51 (0.17)	0.22 (0.17)	--	--
Orchard	--	0.08 (0.17)	0.24 (0.17)	--	--
Perennial	--	--	--	--	--
	S2 (mg HC g⁻¹ rock)				
Annual grain	3.06 (0.49)	1.73 (0.49)	2.30 (0.37)	--	2.30 (0.78)
Forage	3.45 (1.11)	--	1.64 (1.11)	2.22 (1.11)	--
Vegetable	--	3.34 (1.11)	2.09 (1.11)	--	--
Orchard	--	0.95 (1.11)	1.64 (1.11)	--	--
Perennial	--	--	--	--	--
	S3CO₂ (mg CO₂ g⁻¹ rock)				
Annual grain	2.84 (0.40)	1.92 (0.40)	2.64 (0.29)	--	2.26 (0.63)
Forage	4.76 (0.89)	--	5.49 (0.89)	2.86 (0.89)	--
Vegetable	--	2.75 (0.89)	2.09 (0.89)	--	--
Orchard	--	1.70 (0.89)	2.14 (0.89)	--	--
Perennial	--	--	--	--	--
	Generative organic C (%)				
Annual grain	0.40 (0.06)	0.24 (0.06)	0.32 (0.04)	--	0.31 (0.09)
Forage	0.52 (0.13)	--	0.67 (0.13)	0.33 (0.13)	--
Vegetable	--	0.42 (0.13)	0.27 (0.13)	--	--
Orchard	--	0.16 (0.13)	0.27 (0.13)	--	--
Perennial	--	--	--	--	--
	Non-generative organic C (%)				
Annual grain	1.40 (0.15)	0.96 (0.15)	1.11 (0.11)	--	1.08 (0.23)
Forage	1.66 (0.33)	--	1.95 (0.33)	1.13 (0.33)	--
Vegetable	--	1.55 (0.33)	1.07 (0.33)	--	--
Orchard	--	0.57 (0.33)	0.95 (0.33)	--	--
Perennial	--	--	--	--	--

^zConventional tillage represents plow tillage in our study.

^yNo disturbance represented little to no soil movement and was associated mainly with pastures and perennial forages.

^xrepresents standard error of treatment means.

--=not applicable.

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25 **Table S3** Within medium-textured soil (n=46), interactive effect of cropping system and tillage intensity treatment
 26 on the programmed pyrolysis parameters analyzed in the Ontario Topsoil Sampling Project in 2019.

	Conventional tillage ^z	Moderate disturbance	Light disturbance	No disturbance ^y	No-tillage
Cropping system	Hydrogen Index (mg HC g⁻¹ OC)				
Annual grain	109 (16.9) ^x	137 (14.6)	134 (8.46)	153 (29.3)	132 (14.6)
Forage	138 (14.6)	180 (14.6)	173 (16.9)	144 (29.3)	130 (29.3)
Vegetable	132 (29.3)	136 (29.3)	--	--	--
Orchard	161 (29.3)	--	208 (29.3)	--	--
Perennial	--	--	--	200 (13.1)	--
	Oxygen Index (mg CO₂ g⁻¹ OC)				
Annual grain	182 (14.9)	192 (12.9)	190 (7.48)	203 (25.9)	225 (12.9)
Forage	206 (12.9)	189 (12.9)	186 (14.9)	199 (25.9)	195 (25.9)
Vegetable	156 (25.9)	173 (25.9)	--	--	--
Orchard	168 (25.9)	--	192 (25.9)	--	--
Perennial	--	--	--	188 (11.5)	--
	T50 (°C)				
Annual grain	418 (4.90)	421 (4.24)	421 (2.45)	420 (8.48)	425 (4.24)
Forage	417 (4.24)	416 (4.24)	414 (4.90)	419 (8.48)	430 (8.48)
Vegetable	419 (8.48)	410 (8.48)	--	--	--
Orchard	427 (8.48)	--	412 (8.48)	--	--
Perennial	--	--	--	--	412 (3.79)
	S1 (mg HC g⁻¹ rock)				
Annual grain	0.18 (0.12)	0.30 (0.10)	0.27 (0.06)	0.29 (0.21)	0.25 (0.10)
Forage	0.35 (0.10)	0.64 (0.10)	0.42 (0.12)	0.28 (0.21)	0.30 (0.21)
Vegetable	0.16 (0.21)	0.28 (0.21)	--	--	--
Orchard	0.24 (0.21)	--	0.56 (0.21)	--	--
Perennial	--	--	--	0.80 (0.09)	--
	S2 (mg HC g⁻¹ rock)				
Annual grain	1.43 (0.75)	2.42 (0.65)	2.28 (0.37)	2.44 (1.31)	2.34 (0.65)
Forage	2.53 (0.65)	4.58 (0.65)	3.03 (0.75)	2.50 (1.31)	2.97 (1.31)
Vegetable	1.44 (1.31)	2.04 (1.31)	--	--	--
Orchard	2.21 (1.31)	--	4.24 (1.31)	--	--
Perennial	--	--	--	4.97 (0.58)	--
	S3CO₂ (mg CO₂ g⁻¹ rock)				
Annual grain	2.30 (0.72)	3.18 (0.62)	3.29 (0.36)	3.22 (1.25)	4.24 (0.62)
Forage	3.76 (0.62)	4.76 (0.62)	3.18 (0.72)	3.44 (1.25)	4.43 (1.25)
Vegetable	1.70 (1.25)	2.60 (1.25)	--	--	--
Orchard	2.30 (1.25)	--	3.91 (1.25)	--	--
Perennial	--	--	--	4.43 (0.56)	--
	Generative organic C (%)				
Annual grain	0.23 (0.09)	0.34 (0.07)	0.34 (0.04)	0.36 (0.07)	0.36 (0.07)
Forage	0.37 (0.07)	0.60 (0.07)	0.40 (0.09)	0.37 (0.15)	0.43 (0.15)
Vegetable	0.21 (0.15)	0.29 (0.15)	--	--	--
Orchard	0.29 (0.15)	--	0.54 (0.15)	--	--
Perennial	--	--	--	0.64 (0.07)	--
	Non-generative organic C (%)				
Annual grain	1.03 (0.21)	1.32 (0.18)	1.34 (0.10)	1.22 (0.37)	1.43 (0.18)
Forage	1.44 (0.18)	1.90 (0.18)	1.29 (0.21)	1.35 (0.37)	1.84 (0.37)
Vegetable	0.88 (0.37)	1.20 (0.37)	--	--	--
Orchard	1.07 (0.37)	--	1.50 (0.37)	--	--
Perennial	--	--	--	1.71 (0.16)	--

^zConventional tillage represents plow tillage in our study.

^yNo disturbance represented little to no soil movement and was associated mainly with pastures and perennial forages.

^xrepresents standard error of treatment means.

--=not applicable.

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32 **Table S4** Within fine-textured soil (n=76), interactive effect of cropping system and tillage intensity treatment on
 33 the programmed pyrolysis parameters analyzed in the Ontario Topsoil Sampling Project in 2019.

	Conventional tillage ^z	Moderate disturbance	Light disturbance	No disturbance ^y	No-tillage
Cropping system	Hydrogen Index (mg HC g ⁻¹ OC)				
Annual grain	126 (9.47) ^x	125 (9.07)	137 (8.40)	115 (31.4)	137 (8.40)
Forage	133 (18.1)	115 (31.4)	142 (12.8)	--	174 (31.4)
Vegetable	--	--	--	--	--
Orchard	--	--	--	161 (31.4)	--
Perennial	158 (22.2)	171 (31.4)	--	150 (12.8)	--
	Oxygen Index (mg CO ₂ g ⁻¹ OC)				
Annual grain	187 (6.97)	186 (6.67)	187 (6.18)	197 (23.1)	182 (6.18)
Forage	209 (13.3)	217 (23.1)	181 (9.44)	--	173 (23.1)
Vegetable	--	--	--	--	--
Orchard	--	--	--	195 (23.1)	--
Perennial	207 (16.3)	167 (23.1)	--	211 (9.44)	--
	T50 (°C)				
Annual grain	429 (2.45)	427 (2.35)	427 (2.17)	438 (8.14)	428 (2.17)
Forage	426 (4.70)	417 (8.14)	429 (3.32)	--	434 (8.14)
Vegetable	--	--	--	--	--
Orchard	--	--	--	426 (8.14)	--
Perennial	424 (5.75)	446 (8.14)	--	424 (3.32)	--
	S1 (mg HC g ⁻¹ rock)				
Annual grain	0.28 (0.16)	0.47 (0.16)	0.34 (0.14)	0.07 (0.55)	--
Forage	0.25 (0.32)	0.28 (0.55)	0.36 (0.22)	--	0.57 (0.55)
Vegetable	--	--	--	--	--
Orchard	--	--	--	0.39 (0.55)	--
Perennial	0.62 (0.39)	0.42 (0.55)	--	0.68 (0.22)	--
	S2 (mg HC g ⁻¹ rock)				
Annual grain	3.19 (1.35)	3.84 (1.29)	2.89 (1.20)	1.14 (4.49)	4.46 (1.20)
Forage	2.54 (2.59)	1.88 (4.49)	3.38 (1.83)	--	5.03 (4.49)
Vegetable	--	--	--	--	--
Orchard	--	--	--	4.11 (4.49)	--
Perennial	4.82 (3.18)	5.75 (4.49)	--	4.98 (1.83)	--
	S3CO ₂ (mg CO ₂ g ⁻¹ rock)				
Annual grain	3.92 (0.92)	4.94 (0.88)	3.95 (0.81)	1.95 (3.05)	4.63 (0.81)
Forage	4.05 (1.76)	3.55 (3.05)	4.37 (1.24)	--	5.01 (3.05)
Vegetable	--	--	--	--	--
Orchard	--	--	--	4.97 (3.05)	--
Perennial	6.16 (2.15)	5.63 (3.05)	--	6.01 (1.24)	--
	Generative organic C (%)				
Annual grain	0.43 (0.15)	0.53 (0.14)	0.41 (0.13)	0.18 (0.51)	0.58 (0.13)
Forage	0.38 (0.29)	0.30 (0.51)	0.47 (0.21)	--	0.65 (0.51)
Vegetable	--	--	--	--	--
Orchard	--	--	--	0.58 (0.51)	--
Perennial	0.67 (0.36)	0.73 (0.51)	--	0.69 (0.21)	--
	Non-generative organic C (%)				
Annual grain	1.73 (0.42)	2.20 (0.40)	1.66 (0.37)	0.81 (1.39)	2.02 (0.37)
Forage	1.53 (0.80)	1.32 (1.39)	1.89 (0.57)	--	2.23 (1.39)
Vegetable	--	--	--	--	--
Orchard	--	--	--	1.97 (1.39)	--
Perennial	2.33 (0.98)	2.62 (1.39)	--	2.33 (0.57)	--

^zConventional tillage represents plow tillage in our study.

^yNo disturbance represented little to no soil movement and was associated mainly with pastures and perennial forages.

^xrepresents standard error of treatment means.

--=not applicable

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38 **Table S5** Within each soil textural class, mean (SE) values of the soil C indicators (n=1490) and
 39 programmed pyrolysis parameters (n=151) by the tillage intensity in the Ontario Topsoil Sampling Project
 40 from 2019 to 2022.

	SOC	C _{min} -96h	POXC	Solvita CO ₂ - burst	ACE	T50	HI	OI
	mg g ⁻¹	mg CO ₂ -C 20 g ⁻¹ soil	µg g ⁻¹	mg kg ⁻¹	mg kg ⁻¹	°C	mg HC g ⁻¹ OC	mg CO ₂ g ⁻¹ OC
Coarse-textured								
Tillage intensity								
Conventional tillage ^z	17.2 (1.50) ^y	14.9 (2.14)	469 (32.3)	64.2 (8.37)	9.32 (1.12)	415 (2.53)	161 (10.8)	167 (10.2)
Moderate disturbance	15.6 (1.00)	15.7 (1.63)	458 (22.1)	72.0 (6.06)	5.92 (1.07)	415 (2.63)	140 (11.3)	164 (10.6)
Light disturbance	17.5 (1.00)	16.4 (1.57)	461 (21.3)	67.7 (5.77)	6.98 (0.93)	416 (1.93)	155 (8.29)	176 (7.82)
No disturbance ^x	15.0 (1.50)	17.6 (1.98)	440 (31.3)	57.9 (8.34)	2.10 (2.64)	408 (6.50)	145 (27.9)	190 (26.3)
No tillage	17.5 (1.70)	14.0 (2.15)	484 (35.8)	57.8 (9.35)	7.24 (1.78)	422 (4.76)	150 (20.4)	172 (19.3)
Medium-textured								
Conventional tillage	20.6 (0.70)	21.1 (1.09)	549 (16.5)	67.4 (4.25)	6.42 (0.69)	419 (2.78)	130 (11.2)	187 (7.95)
Moderate disturbance	20.8 (0.76)	20.3 (0.89)	554 (14.9)	76.9 (4.60)	7.37 (0.72)	418 (2.84)	157 (11.5)	186 (8.13)
Light disturbance	20.7 (0.60)	22.0 (0.92)	562 (14.8)	76.6 (4.15)	6.78 (0.61)	419 (2.10)	147(8.55)	191 (6.03)
No disturbance	20.0 (0.80)	22.2 (1.10)	565 (18.3)	74.3 (5.86)	6.41 (1.05)	414 (3.29)	186 (13.3)	186 (9.41)
No tillage	19.4 (0.50)	19.7 (0.95)	511 (16.4)	75.4 (5.97)	7.46 (0.82)	426 (3.74)	132 (15.1)	217 (10.7)
Fine-textured								
Conventional tillage	25.3(1.40)	25.6 (1.56)	644ab (26.7)	92.9 (5.18)	7.25 (0.74)	428 (2.02)	132 (7.77)	194 (5.73)
Moderate disturbance	25.0 (1.10)	26.0 (1.20)	647a (23.0)	89.8 (4.95)	6.91 (0.80)	429 (2.25)	131 (8.63)	189 (6.36)
Light disturbance	25.6 (1.20)	26.9 (1.29)	644a (23.7)	96.8 (4.68)	7.69 (0.77)	428 (1.85)	139 (7.12)	185 (5.25)
No disturbance	25.7 (1.40)	28.1 (1.61)	599ab (28.7)	95.8 (5.56)	5.97 (0.78)	426 (3.01)	145 (11.5)	206 (8.53)
No tillage	23.9 (1.40)	27.1 (1.80)	576b (28.5)	100 (5.33)	7.77 (0.82)	429 (2.12)	141 (8.16)	183 (6.02)

41 ^zConventional tillage represents plow tillage in our study.

42 ^yrepresents standard error of treatment means.

43 ^xNo disturbance represented little to no soil movement and was associated mainly with pastures and perennial forages.

44 SOC=soil organic C; C_{min}-96h= 96-hr carbon mineralization; POXC=permanganate oxidizable carbon; Solvita CO₂-burst= 24 h soil respiration
 45 test; ACE=autoclaved citrate extractable protein index; HI=hydrogen index; and OI=oxygen index.

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49 **Table S6** Within each soil textural class, mean (SE) values of the soil C indicators (n=1490) and
 50 programmed pyrolysis parameters (n=151) by the cover crop usage in the Ontario Topsoil Sampling
 51 Project from 2019 to 2022.

	SOC	C _{min} -96h	POXC	Solvita CO ₂ -burst	ACE	T50	HI	OI
	mg g ⁻¹	mg CO ₂ -C 20 g ⁻¹ soil	µg g ⁻¹	mg kg ⁻¹	mg kg ⁻¹	°C	mg HC g ⁻¹ OC	mg CO ₂ g ⁻¹ OC
Cover crop								
	Coarse-textured							
Yes	16.2 (1.10) ^z	16.5 (1.49)	471 (20.9)	61.6 (5.83)	4.89b (1.04)	419a (2.58)	140 (11.2)	177 (10.4)
No	16.9 (0.90)	14.9 (1.36)	454 (18.5)	66.3 (5.06)	7.73a (0.87)	412b (1.85)	160 (7.96)	171 (7.51)
	Medium-textured							
Yes	20.3 (0.50)	20.9 (0.79)	539 (12.1)	73.1 (3.19)	7.16 (0.54)	419 (2.11)	151 (8.58)	185b (6.05)
No	20.3 (0.50)	21.2 (0.73)	557 (11.2)	75.1 (3.11)	6.61 (0.40)	420 (1.64)	149 (6.68)	202a (4.71)
	Fine-textured							
Yes	25.7 (1.10)	26.3 (1.16)	636 (21.8)	92.3 (4.14)	6.73 (0.59)	429 (1.77)	137 (6.82)	191 (5.02)
No	24.6 (1.00)	27.1 (1.10)	608 (20.8)	98.0 (4.04)	7.50 (0.62)	427 (1.25)	138 (4.82)	192 (3.55)

^zrepresents standard error of treatment means.

SOC=soil organic C; C_{min}-96h= 96-hr carbon mineralization; POXC=permanganate oxidizable carbon; Solvita CO₂-burst= 24 h soil respiration test; ACE=autoclaved citrate extractable protein index; HI=hydrogen index; and OI=oxygen index.

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56 **Table S7** Within each soil textural class, mean values of the soil C indicators (n=1490) and programmed
 57 pyrolysis parameters (n=151) by the use of organic amendments in the Ontario Topsoil Sampling Project
 58 from 2019 to 2022.

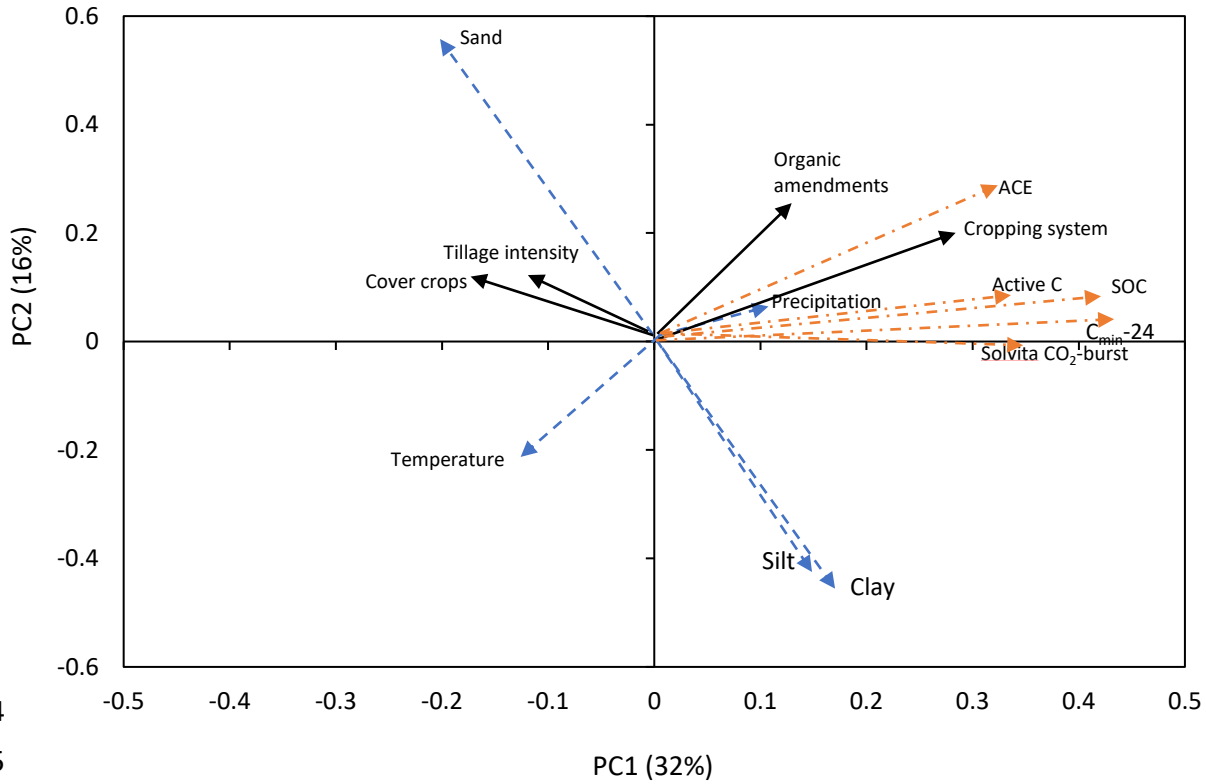
	SOC	C _{min} -96h	POXC	Solvita CO ₂ -burst	ACE	T50	HI	OI
	mg g ⁻¹	mg CO ₂ - C 20 g ⁻¹ soil	µg g ⁻¹	mg kg ⁻¹	mg kg ⁻¹	°C	mg HC g ⁻¹ OC	mg CO ₂ g ⁻¹ OC
Use of organic amendments								
				Coarse-textured				
Yes	16.6 (0.90) ^z	16.0 (1.47)	479 (19.6)	64.2 (5.37)	6.05 (0.85)	417 (2.10)	146 (9.03)	181 (8.52)
No	16.5 (0.90)	15.4 (1.36)	446 (18.8)	63.2 (5.70)	6.57 (1.12)	413 (2.57)	154 (11.0)	167 (10.4)
				Medium-textured				
Yes	20.5 (0.40)	21.1 (0.72)	561 (11.0)	78.4a (2.96)	6.82 (0.45)	419 (1.70)	147 (6.91)	193 (4.88)
No	20.0 (0.50)	21.0 (0.77)	535 (12.0)	69.9b (3.42)	6.95 (0.52)	419 (2.02)	153 (8.19)	193 (5.78)
				Fine-textured				
Yes	25.0 (1.00)	27.3 (1.10)	634 (20.8)	96.2 (4.13)	7.59 (0.63)	430 (1.53)	143 (5.89)	195 (4.34)
No	25.2 (1.10)	26.1 (1.14)	610 (21.6)	94.1 (4.07)	6.64 (0.60)	426 (1.48)	131 (5.69)	187 (4.19)

^zrepresents standard error of treatment means.

SOC=soil organic C; C_{min}-96h= 96-hr carbon mineralization; POXC=permanganate oxidizable carbon; Solvita CO₂-burst= 24 h soil respiration test; ACE=autoclaved citrate extractable protein index; HI=hydrogen index; and OI=oxygen index.

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66 **Figure S1** Principal component analysis (PCA) demonstrating relationships between site characteristics (blue dash-
67 line vectors), management practices (black solid-line vectors), and soil C indicators (orange dash-line vectors,
68 n=1490), sampled in the Ontario Topsoil Sampling Project from 2019 to 2022. ACE=autoclaved citrate extractable
69 protein index; C_{min}-96h= 96-hr carbon mineralization; POXC=permanganate oxidizable carbon; SOC=soil organic
70 carbon; and Solvita CO₂-burst= 24 h soil respiration test.

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