



Supplement of

What is the stability of additional organic carbon stored thanks to alternative cropping systems and organic waste product application? A multi-method evaluation

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Table. S1: Mass and C distribution in size and density fractions after 21 years of organic wastes products (OWPs) application. Mean \pm standard deviation of 4 replicates. Soils were sampled in all treatments with application of municipal solid waste (MSW) compost, biowaste compost (BIOW), farmyard manure (FYM), and the control without organic input (CON-QA). The different letters indicate significant differences between treatments at the 5%.

Mass fraction (g.kg ⁻¹ Bulk soil)									
Treatment	Bulk soil	cPOM	fPOM	cSand	fSand	csilt	fSilt	Clay	Recovery (%)
CON-QA		2.73 \pm 1.16 b	6.26 \pm 0.75 b	8.36 \pm 1.66 c	74.21 \pm 11.05	441.3 \pm 16.38	255.79 \pm 7.26	211.34 \pm 24.46	94.32 \pm 1.17
MSW		2.86 \pm 0.19 b	10.13 \pm 2.60 a	29.51 \pm 20.73 b	75.35 \pm 8.96	425.79 \pm 7.59	240.46 \pm 25.51	215.90 \pm 20.90	92.63 \pm 1.43
FYM		2.76 \pm 0.53 b	13.22 \pm 1.33 a	13.18 \pm 1.56 b	79.66 \pm 11.69	434.48 \pm 8.88	211.25 \pm 40.83	245.45 \pm 30.23	93.45 \pm 1.13
BIOW		3.90 \pm 0.89 a	10.77 \pm 1.56 a	22.04 \pm 4.48 a	74.82 \pm 3.69	437.65 \pm 21.41	212.86 \pm 36.01	237.96 \pm 46.04	93.87 \pm 1.74
	ANOVA	P<0.05	P<0.05	P<0.05	P>0.05	P>0.05	P>0.05	P>0.05	P>0.05
Carbon content in fraction (g C. kg ⁻¹ fraction)									
CON-QA		374.21 \pm 30.87	166.38 \pm 31.41 bc	5.14 \pm 0.75 c	0.81 \pm 0.14 a	1.07 \pm 0.14 c	0.83 \pm 0.15	30.55 \pm 1.15 bc	
MSW		384.17 \pm 63.40	177.21 \pm 32.61 b	7.38 \pm 0.59 b	0.54 \pm 0.30 ab	1.35 \pm 0.09 b	1.04 \pm 0.36	36.44 \pm 2.48 ab	
FYM		383.91 \pm 53.51	184.95 \pm 15.36 ab	11.14 \pm 1.14 b	0.60 \pm 0.20 ab	1.41 \pm 0.07 b	1.44 \pm 0.84	35.03 \pm 5.25 ab	
BIOW		391.03 \pm 4.17	219.02 \pm 19.21 a	19.60 \pm 2.65 a	0.84 \pm 0.09 a	1.95 \pm 0.34 a	1.25 \pm 0.32	40.21 \pm 6.59 a	
	ANOVA	P>0.05	P<0.05	P<0.05	P<0.05	P<0.05	P>0.05	P<0.05	
Carbon content in Bulk soil (g C. kg ⁻¹ Bulk soil)									
CON-QA	9.92 \pm 0.63 c	1.03 \pm 0.48 bc	1.02 \pm 0.09 c	0.04 \pm 0.01 c	0.06 \pm 0.02	0.47 \pm 0.06 cd	0.21 \pm 0.04	7.13 \pm 0.60 c	111.18 \pm 9.41
MSW	13.84 \pm 0.16 b	1.10 \pm 0.21 ab	1.73 \pm 0.21 b	0.21 \pm 0.15 b	0.04 \pm 0.02	0.58 \pm 0.04 bc	0.25 \pm 0.11	8.49 \pm 0.35 b	93.92 \pm 3.17
FYM	13.91 \pm 0.37 b	1.08 \pm 0.35 ab	2.43 \pm 0.13 a	0.15 \pm 0.03 b	0.05 \pm 0.02	0.61 \pm 0.04 bc	0.29 \pm 0.16	9.17 \pm 0.94 ab	103.94 \pm 9.33
BIOW	16.04 \pm 0.68 a	1.53 \pm 0.35 a	2.34 \pm 0.21 a	0.44 \pm 0.14 a	0.06 \pm 0.009	0.85 \pm 0.14 a	0.26 \pm 0.05	10.12 \pm 0.78 a	102.16 \pm 5.79
	ANOVA	P<0.05	P<0.05	P<0.05	P<0.05	P>0.05	P<0.05	P>0.05	P>0.05
Distribution of total C within the fractions (%)									
CON-QA		10.25 \pm 4.55	10.29 \pm 1.08	0.43 \pm 0.11	0.68 \pm 0.12	4.72 \pm 0.57	2.14 \pm 0.41	71.49 \pm 5.03	
MSW		8.87 \pm 1.66	13.98 \pm 1.73	1.73 \pm 1.21	0.34 \pm 0.38	4.64 \pm 0.36	2.03 \pm 0.88	68.40 \pm 2.39	
FYM		7.84 \pm 2.56	17.65 \pm 1.60	1.06 \pm 0.17	0.65 \pm 0.32	4.45 \pm 0.37	2.09 \pm 0.97	66.25 \pm 2.63	
BIOW		9.75 \pm 2.11	15.00 \pm 1.80	2.79 \pm 0.82	0.69 \pm 0.20	5.44 \pm 0.80	1.66 \pm 0.31	64.66 \pm 2.60	

Table. S2: Mass and C distribution in size and density fractions. Mean \pm standard deviation of 4 replicates. Soils were sampled in conservation agriculture (CA), organic agriculture (ORG) and conventional agriculture (CON-LC). The different letters indicate significant differences between treatments at the 5%.

Mass fraction (g.kg ⁻¹ Bulk soil)									
Treatment	Bulk soil	cPOM	fPOM	cSand	fSand	csilt	fSilt	Clay	Recovery (%)
CON-LC		1.86 \pm 0.60	5.34 \pm 0.84 b	33.22 \pm 4.64	210.39 \pm 16.89	352.64 \pm 19.36	193.97 \pm 40.64	202.99 \pm 18.91	94.83 \pm 2.58
ORG		2.35 \pm 0.21	6.39 \pm 1.17 ab	35.04 \pm 2.60	220.86 \pm 9.53	349.21 \pm 10.36	156.30 \pm 13.03	229.84 \pm 18.62	94.48 \pm 1.24
CA		2.62 \pm 0.59	8.79 \pm 2.19 a	98.68 \pm 68.58	249.02 \pm 69.79	272.11 \pm 90.61	132.68 \pm 38.67	236.11 \pm 25.75	95.63 \pm 2.24
	ANOVA	P>0.05	P<0.05	P>0.05	P>0.05	P>0.05	P>0.05	P>0.05	P>0.05
Carbon content in fraction (g C. kg ⁻¹ fraction)									
CON-LC		295.37 \pm 98.31	123.87 \pm 82.27 b	1.46 \pm 0.17	0.33 \pm 0.14	0.73 \pm 0.20 b	1.09 \pm 0.25b	11.12 \pm 1.49 c	
ORG		324.38 \pm 18.76	173.77 \pm 40.93 a	1.93 \pm 0.68	0.48 \pm 0.09	1.43 \pm 0.23 ab	4.39 \pm 2.21a	26.83 \pm 1.67 b	
CA		309.20 \pm 37.10	160.01 \pm 28.51 ab	2.14 \pm 2.16	0.40 \pm 0.12	2.31 \pm 0.91 a	5.09 \pm 4.35a	35.66 \pm 4.05 a	
	ANOVA	P>0.05	P<0.05	P>0.05	P>0.05	P<0.05	P<0.05	P<0.05	
Carbon content in Bulk soil (g C. kg ⁻¹ Bulk soil)									
CON-LC	9.82 \pm 0.48 b	0.72 \pm 0.30	1.00 \pm 0.09 b	0.08 \pm 0.05	0.10 \pm 0.03	0.47 \pm 0.07	0.55 \pm 0.38	6.42 \pm 0.71 b	102.05 \pm 4.61
ORG	10.39 \pm 0.42 b	0.76 \pm 0.05	1.08 \pm 0.08 b	0.07 \pm 0.03	0.10 \pm 0.02	0.50 \pm 0.07	0.67 \pm 0.29	6.74 \pm 0.51 b	101.15 \pm 6.47
CA	13.30 \pm 1.05 a	0.82 \pm 0.28	1.36 \pm 0.16 a	0.11 \pm 0.03	0.10 \pm 0.04	0.57 \pm 0.05	0.63 \pm 0.03	9.02 \pm 1.05 a	99.31 \pm 6.40
	ANOVA	P<0.05	P>0.05	P<0.05	P>0.05	P>0.05	P>0.05	P<0.05	P>0.05
Distribution of total C within the fractions (%)									
CON-LC		7.11 \pm 2.87	10.03 \pm 1.10	0.80 \pm 0.52	0.94 \pm 0.21	4.64 \pm 0.27	6.31 \pm 0.48	64.01 \pm 3.26	
ORG		7.25 \pm 0.43	10.25 \pm 0.44	0.64 \pm 0.25	1.00 \pm 0.18	4.73 \pm 0.60	6.31 \pm 2.38	64.23 \pm 3.12	
CA		6.19 \pm 1.80	10.35 \pm 1.33	0.87 \pm 0.19	0.74 \pm 0.27	4.32 \pm 0.31	4.15 \pm 2.73	68.40 \pm 0.95	

Table. S3: Carbon stock and additional carbon stock distribution in size and density fractions. Mean \pm standard deviation of 4 replicates. Soils were sampled in all treatments with application of municipal solid waste (MSW) compost, biowaste compost (BIOW), farmyard manure (FYM), and the control without organic input (CON-QA).

Carbon stock (t C. ha ⁻¹)								
	Bulk soil	cPOM	fPOM	cSand	fSand	csilt	fSilt	Clay
CON-QA	39.31 \pm 2.49	4.02 \pm 1.73	4.04 \pm 0.43	0.17 \pm 0.04	0.24 \pm 0.07	1.85 \pm 0.23	0.84 \pm 0.15	28.14 \pm 2.80
MSW	54.03 \pm 0.59	4.79 \pm 0.91	7.55 \pm 0.88	0.93 \pm 0.65	0.17 \pm 0.09	2.51 \pm 0.17	1.09 \pm 0.48	36.98 \pm 1.53
FYM	54.77 \pm 1.39	4.33 \pm 1.52	9.71 \pm 1.02	0.58 \pm 0.10	0.19 \pm 0.07	2.45 \pm 0.19	1.14 \pm 0.50	36.37 \pm 0.52
BIOW	63.17 \pm 2.56	6.15 \pm 1.14	9.48 \pm 0.98	1.77 \pm 0.53	0.25 \pm 0.03	3.44 \pm 0.50	1.05 \pm 0.16	41.02 \pm 3.41
Additional Carbon stock (t C. ha ⁻¹)								
MSW	14.72 \pm 1.28	0.77 \pm 0.98	3.51 \pm 0.49	0.76 \pm 0.33	-0.07 \pm 0.06	0.65 \pm 0.14	0.26 \pm 0.25	8.84 \pm 1.60
FYM	15.46 \pm 1.43	0.31 \pm 1.15	5.66 \pm 0.56	0.42 \pm 0.06	-0.05 \pm 0.05	0.59 \pm 0.15	0.30 \pm 0.26	8.23 \pm 1.42
BIOW	23.86 \pm 1.79	2.12 \pm 1.04	5.44 \pm 0.54	1.60 \pm 0.26	0.01 \pm 0.04	1.59 \pm 0.28	0.21 \pm 0.11	12.88 \pm 2.21

Table. S4: Carbon stock and additional carbon stock distribution in size and density fractions. Mean \pm standard deviation of 4 replicates. Soils were sampled in conservation agriculture (CA), organic agriculture (ORG) and conventional agriculture (CON-LC).

Carbon stock (t C. ha ⁻¹)								
	Bulk soil	cPOM	fPOM	cSand	fSand	csilt	fSilt	Clay
CON-LC	42.21 \pm 2.07	3.01 \pm 1.24	4.22 \pm 0.36	0.34 \pm 0.22	0.40 \pm 0.11	1.96 \pm 0.20	2.67 \pm 0.14	27.03 \pm 1.99
ORG	44.66 \pm 1.80	3.23 \pm 0.07	4.57 \pm 0.15	0.29 \pm 0.11	0.45 \pm 0.08	2.11 \pm 0.27	2.81 \pm 1.02	28.70 \pm 2.16
CA	57.17 \pm 4.53	3.54 \pm 1.06	5.90 \pm 0.72	0.49 \pm 0.10	0.43 \pm 0.19	2.47 \pm 0.29	2.41 \pm 1.66	39.08 \pm 2.58
Additional carbon stock (t C. ha ⁻¹)								
ORG	2.44 \pm 1.38	0.23 \pm 0.62	0.35 \pm 0.19	-0.05 \pm 0.12	0.05 \pm 0.07	0.15 \pm 0.17	0.14 \pm 0.52	1.67 \pm 1.63
CA	14.95 \pm 2.49	0.54 \pm 0.82	1.68 \pm 0.40	0.16 \pm 0.12	0.03 \pm 0.11	0.51 \pm 0.18	-0.26 \pm 0.83	12.05 \pm 1.47

Table S5: Mean physico-chemical characteristics of PROs added to QualiAgro between 1998 and 2011.

Organic amendments	Corg (g.kg ⁻¹ MS)	Norg (g.kg ⁻¹ MS)	C/N	ISMO (% Corg)
MSW	310 \pm 45	17.0 \pm 2.0	18.5 \pm 4.1	49.0 \pm 13.0
FYM	324 \pm 67	21.0 \pm 3.0	15.5 \pm 2.7	66.6 \pm 7.0
BIOW	211 \pm 46	16.9 \pm 4.1	12.6 \pm 1.6	75.5 \pm 6.3

Fig. S1: C/N ratios of cPOM and fPOM fractions in agricultural practices at La Cage and QualiAgro. Mean \pm standard deviation of 4 replicates. Letters represent significant differences between agricultural practices.

