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D1.2. Baseline assessment of core soil properties

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6.	FCSR
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This deliverable describes the bulk soil physical, chemical and biological properties measured for the samples collected in the case studies CS1, CS2, CS3, CS4 and CS6 (described in deliverable 1.1) within the Circular Agronomics WP1 : Plant-Soil-Interactions. This baseline aims at presenting the different sites before applying different soils amendments and will serve as benchmark for D1.3. It also presents results obtained for the long-term experiments at CS1 and CS2, as well as for the on-farm experiment (CS3). Due to a combination of the Covid-19 pandemic and a delay in the production of rest products (Pondus) to be applied in field experiments, sampling of the Gelderland case study (CS5) was delayed and will be combined with the final sampling campaign (D1.3).

1. Soil sampling

1.1. Case study regions sampled

In summer and fall 2019, a team from TUM & WUR carried out soil sampling at five of the six case study sites. Sampling was done (i) on-farm (CS3), (ii) on several long term experiments (CS1, CS2) and (ii) on the newly started experiments to determine baselines (CS4, CS5) (**Table 1**). For detailed descriptions of the sites please refer to D1.1.

Table 1: Case study regions sampled in summer and fall 2019

Case study	Sampling time	Sub-sites	Type of sampling	Core-sample for bulk analysis
CS1 Catalonia, Spain	09/19	Tona (CS1.1)	Long-term experiment	12
		Mas-Badia (CS1.2)	Long-term experiment	9
CS2 Brandenburg, Germany	10/19	na	Long-term experiment	24
CS3 Lungau, Austria	06/19	na	On-farm	45
CS4 Emilia-Romagna, Italy	09/19	Correggio (CS4.1)	Baseline	5
		Parma (CS4.2)	Baseline	5
CS6 South Moravia, Czech Republic	10/19	na	Baseline	4
			Total	**104**

Due to the delay in the production of the Pondus products, as well as the partial lockdown due to the COVID-19 pandemic, establishment of the experiments in subtask 1.3.3 has been delayed. For that reason, the baseline sampling of experiments established in CS2 (Brandenburg) and CS5 (Gelderland) were not conducted. As the final sampling of those experiments would take place in 2021, shortly after the date most Covid restrictions will likely be ended, sampling the baseline in the fall of 2020 was considered to be neither possible nor useful. Both the experiments in CS2 and CS5 are well replicated and have proper control treatments, with the control being a good proxy for baseline. Therefore, we do not expect that this will significantly decrease the power of detection of our analyses.

1.2. Sampling procedure

Using an electrical corer (**Figure 1**), 104 core-samples (**Table 1**) were taken for bulk soil analysis from the study sites and divided into five depths: 0-10 cm, 10-20 cm, 20-40 cm, 40-80 cm and 80-100 cm. The bulk soil samples for all sites were homogenized, air-dried at room temperature, ground and sieved through a 2 mm mesh prior to lab analysis.

Figure 1: Soil sampling using an electrical corer.

2. Soil analyses

2.1. Soil chemical properties

Following the laboratory protocols described in deliverable 1.1, the following soil chemical properties were measured:

1. pH-$CaCl_2$
2. Gravimetric water content
3. Total carbon content (TC)
4. Total nitrogen content (TN)
5. Organic carbon content (OC)
6. Dissolved organic nitrogen content (DON)
7. Ammonium content (N-NH_4^+)
8. Nitrate and nitrite content (N-NO_3^-) and (N-NO_2^-)
9. Readily plant-available Phosphorus content (CaCl$_2$-P)

The partial lockdown at WUR due to the COVID-19 pandemic resulted in a delay in some of the additional phosphorus analyses, due to strict occupancy rules in the laboratory, following the national guidelines. Therefore, $CaCl_2$-P was analyzed in line with the nitrogen extractions. In January 2021, P-Olsen will be measured from sites with a pH >7 (26 samples) and the Mehlich3-P will be measured on all 0-20 cm pooled samples in March 2021. For wet chemistry analyses the samples from 0-10 cm and 0-20 cm have been pooled due to the high number of samples for analyses (with the exception of CS3 where pooling didn't make any sense).

2.2. Soil biological properties

Following the laboratory protocols described in deliverable 1.1, the following soil biological properties were measured:

1. Potentially mineralisable N ($N_{mineralisable}$)
2. Microbial biomass N (N_{mic})
3. Microbial biomass C (C_{mic})

Biological analyses were performed on the 0-10 cm samples.

2.3. Soil physical properties

Following the laboratory protocols described in deliverable 1.1, the following soil physical properties were measured:

1. Soil texture
2. Bulk density

The soil texture was measured on one control sample for each site, assuming that the addition of organic fertilizers would not change the grain size distribution of the soil mineral fraction. Soil texture analysis is still under progress for CS3, as some of its samples contain either high amounts of carbonates or organic matter, which requires long pre-treatments. Analyses are projected to be completed in March 2021.

3. Results for the on-farm case study (CS3)

Tables 2, **3** and **4** present the soil physical, chemical and biological properties measured on the 15 farms from CS3. Soil properties differed considerably between farms. The soil pH values ranged from 4.7 to 7.3 across farms and soil depths (**Table 2** and **3**). The OC, N, DON, N-NH_4^+, N-(NO_3^-; NO_2^-) and $CaCl_2$-P contents followed the same trends at the 15 farms, with the highest contents found in the upper 20 cm of the soil profile and with decreasing contents down to one meter. However, the OC and nutrient contents varied across the 15 farms, e.g., the OC content varied between 33 and 59 g kg^{-1} in the top 10 cm. The contrast among farms was also clear with respect to the biological soil properties, e.g. the microbial biomass carbon (C_{mic}) varied from 453 to 1094 mg kg^{-1} and the mineralisable nitrogen varied from 11 to 105 mg kg^{-1} (**Table 4**).

Table 2 : Soil physico-chemical properties of first seven farms from the CS3 (AREC). SE : standard error (n = 3).

	Depth	pH-$CaCl_2$		GW		TC		OC		TN		DON		N-NH_4^+		N-(NO_3^-, NO_2^-)		$CaCl_2$-P		BD
	cm			%		g kg^{-1}		g kg^{-1}		g kg^{-1}		mg kg^{-1}		mg kg^{-1}		mg kg^{-1}		mg kg^{-1}		g cm^{-3}
		Mean	SE	Mean	SE	Mean	SE	Mean	SE	Mean	SE	Mean	SE	Mean	SE	Mean	SE	Mean	SE	
Farm 1	0-10	5.8	0.1	25	3.2	39	2.0	38	1.2	3.6	0.1	41	2.7	13	0.2	16	7.6	3.2	0.1	0.87
	10-20	5.5	0.1	19	0.3	24	0.4	24	0.5	2.6	0.0	20	0.7	4	0.4	7	1.9	0.5	0.0	1.08
	20-40	5.6	0.1	9	0.8	10	1.5	10	1.6	1.1	0.1	6	1.5	1	0.7	2	0.3	0.0	0.0	1.07
	40-80	-	-	9	0.2	3	1.2	2	1.3	0.3	0.1	-	-	-	-	-	-	-	-	1.09
	80-100	-	-	9	0.8	1	0.1	1	0.2	0.2	0.0	-	-	-	-	-	-	-	-	1.64
Farm 2	0-10	5.3	0.1	18	1.5	43	2.7	43	2.5	4.3	0.3	39	5.1	10	2.8	11	3.0	1.2	0.5	0.81
	10-20	5.1	0.0	22	1.0	41	3.9	41	4.1	4.2	0.5	32	6.0	5	0.6	17	4.0	0.9	0.4	1.38
	20-40	5.2	0.0	12	0.4	21	0.6	21	0.6	2.0	0.0	8	1.0	1	0.3	3	0.4	0.1	0.0	0.89
	40-80	-	-	8	1.4	6	1.4	6	1.7	0.6	0.1	-	-	-	-	-	-	-	-	0.84
	80-100	-	-	13	0.8	4	0.7	4	0.9	0.5	0.0	-	-	-	-	-	-	-	-	0.91
Farm 3	0-10	5.4	0.1	30	1.5	43	2.2	43	2.5	4.6	0.2	37	5.0	4	0.4	16	2.0	2.1	0.8	0.83
	10-20	5.3	0.0	23	1.5	28	1.2	27	1.5	3.1	0.1	21	3.5	2	0.5	7	0.3	0.4	0.2	1.17
	20-40	5.4	0.1	17	1.4	16	1.1	16	1.0	1.8	0.1	7	1.4	0	0.2	3	1.0	0.0	0.0	1.20
	40-80	-	-	15	2.3	10	0.4	9	0.3	0.9	0.0	-	-	-	-	-	-	-	-	1.35
	80-100	-	-	18	0.7	6	0.1	5	0.1	0.6	0.0	-	-	-	-	-	-	-	-	1.77
Farm 4	0-10	5.1	0.2	28	2.1	42	4.0	42	3.8	3.1	1.4	32	11.4	22	12.6	15	3.0	1.1	0.5	1.06
	10-20	4.7	0.1	19	1.3	18	1.2	17	1.1	1.3	0.6	11	1.2	1	0.3	4	0.7	0.0	0.0	1.53
	20-40	4.8	0.0	17	0.8	11	0.3	10	0.3	0.8	0.3	4	0.3	0	0.0	2	0.2	0.0	0.0	1.40
	40-80	-	-	18	1.1	8	0.4	8	0.5	0.6	0.3	-	-	-	-	-	-	-	-	1.42
	80-100	-	-	19	1.7	8	0.3	7	0.3	0.6	0.3	-	-	-	-	-	-	-	-	1.41
Farm 5	0-10	5.2	0.1	22	1.8	32	1.4	33	1.6	3.2	0.1	30	2.2	7	1.3	25	6.9	0.9	0.1	0.59
	10-20	5.1	0.1	17	1.8	27	0.8	26	1.1	2.7	0.1	19	2.1	3	0.5	11	2.1	0.3	0.1	1.07
	20-40	5.2	0.1	7	0.5	12	1.5	11	1.5	1.1	0.2	6	1.1	1	0.1	4	1.1	0.0	0.0	0.55
	40-80	-	-	21	2.4	12	0.7	11	0.7	1.1	0.1	-	-	-	-	-	-	-	-	1.15
	80-100	-	-	23	0.9	11	0.6	10	0.5	1.0	0.1	-	-	-	-	-	-	-	-	1.15
Farm 6	0-10	5.7	0.1	29	0.4	58	0.8	58	0.7	5.6	0.0	41	2.8	15	0.3	12	3.4	1.5	0.3	0.91
	10-20	5.5	0.1	17	0.4	28	0.4	26	2.2	2.8	0.1	15	0.6	3	0.7	3	0.9	0.1	0.0	1.04
	20-40	5.5	0.0	8	1.0	12	1.4	12	1.2	1.1	0.1	5	0.9	1	0.0	1	0.1	0.0	0.0	1.06
	40-80	-	-	7	1.5	3	0.2	3	0.2	0.3	0.0	-	-	-	-	-	-	-	-	0.85
	80-100	-	-	8	1.2	1	0.2	1	0.2	0.1	0.0	-	-	-	-	-	-	-	-	0.95
Farm 7	0-10	6.5	0.0	37	3.6	51	10.2	49	9.9	4.8	1.1	49	2.0	52	41.6	25	19.8	11.5	5.2	0.89
	10-20	5.7	0.1	27	0.5	29	3.8	27	3.4	2.6	0.3	11	1.9	1	0.3	2	0.8	0.1	0.0	1.16
	20-40	5.0	0.0	23	2.2	10	1.3	10	1.3	1.0	0.2	5	0.9	4	1.3	0	0.1	0.0	0.0	1.42
	40-80	-	-	25	1.1	6	1.1	5	1.1	0.5	0.1	-	-	-	-	-	-	-	-	1.42
	80-100	-	-	32	1.5	14	1.2	13	1.2	1.2	0.1	-	-	-	-	-	-	-	-	1.17

*No samples for one of the replicate; **No samples for two of the replicates; GW : gravimetric water content; TC : total carbon content; OC : organic carbon content; TN : total nitrogen content; Nts : Dissolved organic nitrogen content ; N-NH_4^+ : Ammonium content; P-PO_4 : Phosphorus content in form of phosphate; BD : Bulk density

Table 3 : Soil physico-chemical properties of last eight farms from the CS3 (AREC). SE : standard error (n = 3).

	Depth	pH-$CaCl_2$		GW		TC		OC		TN		DON		N-NH_4^+		N-(NO_3^-, NO_2^-)		$CaCl_2$-P		BD
	cm			%		g kg^{-1}		g kg^{-1}		g kg^{-1}		mg kg^{-1}		mg kg^{-1}		mg kg^{-1}		mg kg^{-1}		g cm^{-3}
		Mean	SE	Mean	SE	Mean	SE	Mean	SE	Mean	SE	Mean	SE	Mean	SE	Mean	SE	Mean	SE	
Farm 8	0-10	5.7	0.1	29	1.5	38	1.6	38	1.8	3.8	0.1	44	5.7	11	3.1	21	5.4	2.4	0.9	0.90
	10-20	5.6	0.1	24	1.2	23	1.7	22	1.7	2.2	0.2	14	1.4	2	0.2	4	1.2	0.1	0.0	1.10
	20-40	5.7	0.1	14	1.7	7	1.1	6	1.0	0.7	0.1	4	0.7	1	0.1	2	0.4	0.0	0.0	0.69
	40-80	-	-	10	1.1	2	0.2	1	0.2	0.2	0.0	-	-	-	-	-	-	-	-	1.40
	80-100*	-	-	9	0.9	1	0.1	1	0.0	0.2	0.0	-	-	-	-	-	-	-	-	1.78
Farm 9	0-10	5.6	0.0	28	1.6	40	2.2	39	2.0	4.0	0.1	44	3.7	11	1.3	12	1.3	0.7	0.1	0.92
	10-20	5.2	0.1	22	0.5	23	1.2	22	1.5	2.3	0.1	16	2.4	3	0.6	2	0.6	0.0	0.0	1.11
	20-40	5.3	0.0	21	0.3	16	1.4	15	1.3	1.5	0.1	7	1.3	1	0.2	3	0.7	0.0	0.0	1.00
	40-80	-	-	10	0.2	3	0.3	3	0.3	0.3	0.0	-	-	-	-	-	-	-	-	1.18
	80-100	-	-	8	0.3	2	0.1	1	0.1	0.2	0.0	-	-	-	-	-	-	-	-	1.49
Farm 10	0-10	5.8	0.2	27	3.5	51	9.0	49	8.4	5.3	0.8	68	13.6	22	4.1	46	2.1	12.2	5.8	0.70
	10-20	6.7	0.1	16	0.9	15	1.7	14	1.4	1.8	0.1	9	0.2	1	0.3	5	0.2	0.0	0.0	1.02
	20-40	7.3	0.1	13	1.8	17	2.5	11	1.7	1.3	0.1	4	0.5	1	0.1	3	0.3	0.0	0.0	0.86
	40-80	-	-	5	0.4	28	1.9	2	0.6	0.5	0.0	-	-	-	-	-	-	-	-	0.49
	80-100**	-	-	6	-	62	-	8	-	0.6	-	-	-	-	-	-	-	-	-	0.64
Farm 11	0-10	6.5	0.1	22	2.6	61	1.5	59	1.6	6.0	0.1	43	2.8	16	1.3	24	10.4	2.8	0.3	0.66
	10-20	5.5	0.1	19	1.5	31	1.8	31	2.9	3.0	0.2	17	1.2	3	0.3	4	0.9	0.9	0.0	0.99
	20-40	5.5	0.1	14	1.4	22	1.2	21	0.8	2.0	0.1	10	0.4	1	0.1	4	0.5	0.5	0.0	0.73
	40-80	-	-	7	2.2	9	0.9	7	1.0	0.7	0.1	-	-	-	-	-	-	-	-	0.44
	80-100*	-	-	5	0.5	11	2.1	10	2.5	0.8	0.1	-	-	-	-	-	-	-	-	0.62
Farm 12	0-10	6.9	0.1	17	0.8	37	2.2	34	2.4	3.3	0.2	23	4.2	6	1.9	8	1.2	0.3	0.2	1.02
	10-20	6.8	0.1	21	1.2	39	3.0	35	2.8	3.4	0.2	21	1.9	4	0.5	4	0.1	0.1	0.0	1.08
	20-40	6.8	0.1	20	0.7	28	0.7	24	1.0	2.4	0.1	12	0.4	1	0.1	3	0.5	0.0	0.0	1.19
	40-80	-	-	21	0.3	14	0.3	13	0.5	1.4	0.0	-	-	-	-	-	-	-	-	1.23
	80-100	-	-	20	0.7	10	0.4	10	0.5	0.9	0.1	-	-	-	-	-	-	-	-	1.26
Farm 13	0-10	6.8	0.2	18	3.6	57	2.3	54	2.7	5.8	0.2	33	4.2	10	2.3	3	0.4	2.2	1.2	0.73
	10-20	6.7	0.0	16	1.4	51	4.0	48	4.1	5.3	0.4	28	1.3	7	0.7	3	1.3	0.4	0.1	0.71
	20-40	7.0	0.0	10	0.8	26	2.1	23	1.5	2.4	0.2	10	1.9	1	0.2	6	1.1	0.0	0.0	0.72
	40-80	-	-	12	0.6	17	1.8	13	1.8	1.3	0.2	-	-	-	-	-	-	-	-	0.94
	80-100	-	-	6	1.0	22	2.9	5	1.7	0.6	0.2	-	-	-	-	-	-	-	-	1.09
Farm 14	0-10	7.0	0.1	23	1.3	57	1.2	54	0.6	5.6	0.1	41	3.1	13	1.5	13	6.0	1.1	0.1	0.86
	10-20	6.9	0.0	22	1.7	45	2.0	42	1.7	4.5	0.2	29	0.8	5	0.2	3	0.4	0.1	0.0	0.91
	20-40	7.1	0.0	15	1.7	29	1.3	21	1.4	2.4	0.2	10	1.0	1	0.0	3	0.7	0.0	0.0	1.14
	40-80	-	-	13	0.8	30	3.3	7	4.2	0.9	0.2	-	-	-	-	-	-	-	-	1.10
	80-100	-	-	9	1.2	45	3.2	1	1.5	0.2	0.1	-	-	-	-	-	-	-	-	1.48
Farm 15	0-10	5.4	0.2	23	0.6	49	1.2	48	1.1	4.9	0.1	42	5.0	9	1.7	4	1.4	1.1	0.4	0.99
	10-20	5.1	0.0	21	1.6	33	1.6	32	1.4	3.3	0.2	19	1.0	3	0.3	2	0.8	0.1	0.0	0.74
	20-40	5.3	0.0	17	1.9	17	3.1	16	3.0	1.6	0.3	8	2.4	1	0.2	2	0.9	0.0	0.0	1.09
	40-80	-	-	12	1.0	5	1.3	5	1.3	0.4	0.1	-	-	-	-	-	-	-	-	1.26
	80-100**	-	-	8	-	1	-	1	-	0.3	-	-	-	-	-	-	-	-	-	1.15

*No samples for one of the replicate; **No samples for two of the replicates; GW : gravimetric water content; TC : total carbon content; OC : organic carbon content; TN : total nitrogen content; Nts : Dissolved organic nitrogen content ; N-NH_4^+ : Ammonium content; P-PO_4 : Phosphorus content in form of phosphate; BD : Bulk density

Table 4: Soil biological properties of all farms in CS3 (AREC). Due to the large number of samples, these properties were measured on pooled samples.

	Depth	$N_{mineralisable}$	Nmic	Cmic
	cm	mg kg^{-1}	mg kg^{-1}	mg kg^{-1}
Farm 1	0-10	60	127	1,094
Farm 2	0-10	19	111	777
Farm 3	0-10	75	128	817
Farm 4	0-10	41	105	688
Farm 5	0-10	63	99	630
Farm 6	0-10	21	101	653
Farm 7	0-10	46	70	647
Farm 8	0-10	41	86	622
Farm 9	0-10	64	89	715
Farm 10	0-10	43	73	594
Farm 11	0-10	11	70	648
Farm 12	0-10	105	66	453
Farm 13	0-10	66	143	958
Farm 14	0-10	64	86	966
Farm 15	0-10	BDL	104	924

BDL : below the detection limit

4. Results for the long term experiments (CS1, CS2)

Tables 5 and **6** present the physical, chemical and biological soil properties measured at CS1.1 (Tona) and CS1.2 (Mas-Basia). The **tables 7**, **8** and **9** present the physical, chemical and biological soil properties measured at CS2. The soils of the experimental sites CS1.1 and CS1.2 were classified as Cambisol (IUSS Working Group WRB) with silty loam texture and as fluvic Cambisol (IUSS Working Group WRB) with sandy loam texture, respectively (**Table 5**). The soil at CS2 was classified as a Cambisol (IUSS Working Group WRB) with sandy loam texture in the first 80 cm and sandy clay loam texture below 80 cm (**Table 8**).

The OC and N contents followed the same trends at the three sites (CS1.1, CS1.2 and CS2), with the highest contents in the upper 20 cm of the soil profile (**Table 6** and **9**). The effect of fertilizers on the soil OC and N contents, as well as on the SOC stocks, was particularly site dependent. At CS2, the application of organic fertilizers (whatever their nature) resulted in higher soil OC and N contents in the first 10 cm (**Table 8**), as compared to the control and the mineral fertilizer treatments. The SOC stocks were + 21-33 % higher in the soil treated with organic fertilizers compared with the control treatment (**Figure 3)**. Yet, at CS1, the application of organic fertilizers did not result in higher soil OC contents, N contents and SOC stocks, compared with the mineral fertilizer treatment (**Table 6** and **Figure 2.b**). Another key result was that the form of organic fertilizer also affected the soil OC and N contents, as reflected by the Spanish case study CS1.1 (**Figure 2.a**). The application of pig slurry in solid form resulted in higher soil OC and N contents, as well as SOC stocks, in the first 10 cm. This is most likely explained by the higher initial organic matter content in the solid pig slurry (81.0 %) as compared to the liquid pig slurry (60.5 %). The soil OC and N contents, as well as the SOC stocks, were slightly higher in the 20-40 cm layer when the pig slurry was applied under the liquid form (SOC stocks : 0.31 g cm^{-2} versus 0.25 g cm^{-2}). In addition, a higher N-(NO_3^-; NO_2^-) contents was observed for the liquid pig slurry treatment as compared to the solid treatment in the 20-40 cm soil layer (17 versus 8.0 mg kg^{-1}) (**Table 6**). These results could be driven by the lower organic matter content in the liquid slurry, hampering nitrate immobilization and thus promoting nitrate leaching, as well as the partial translocation of the liquid pig slurry amendment to deeper soil layers.

Figure 2: Soil organic carbon (SOC) stocks from each treatment at the Tona (a.) and Mas Badia (b.) sites over 5 depths (0-10 cm, 10-20 cm, 20-40 cm, 40-80 cm, and 80-100 cm). Error bars represent ± standard error of the mean of three field replicates.

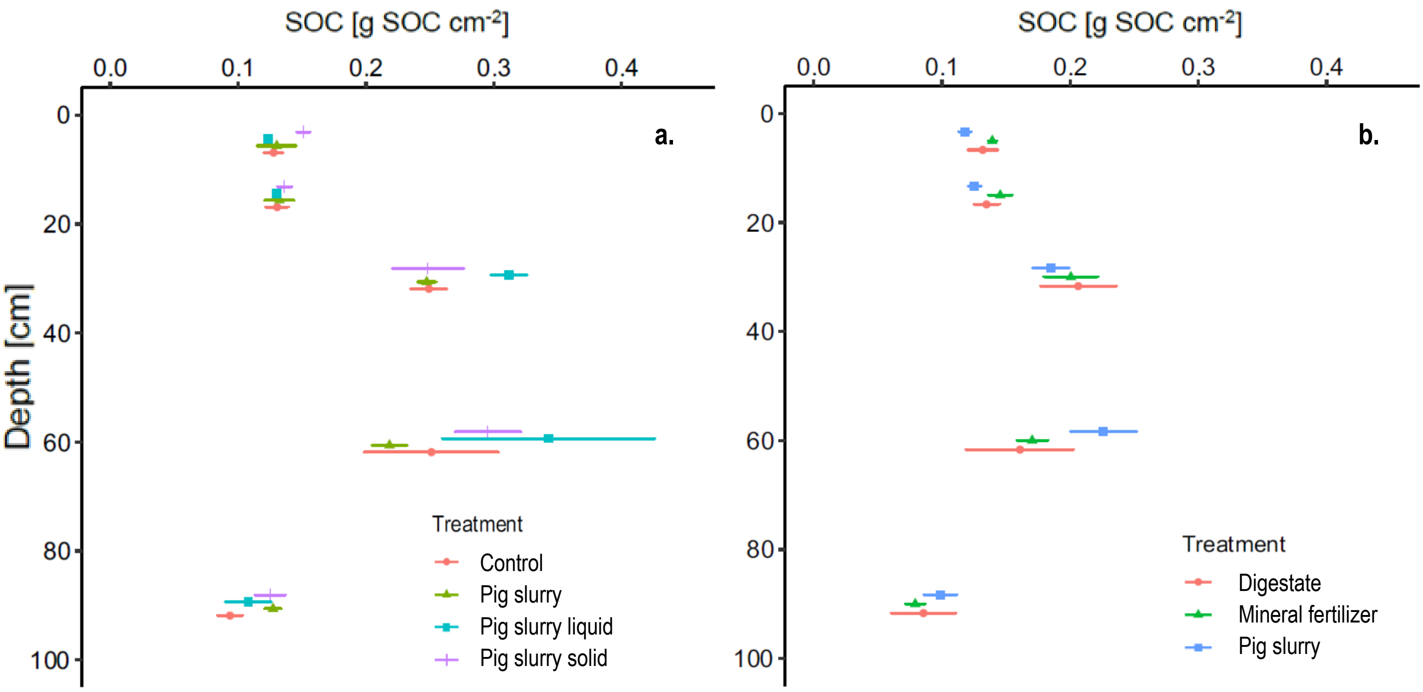

Table 5: Soil texture at the long-term field experiments of CS1.1 (Tona) and CS1.2 (Mas-Basia) (IRTA).

Site	Depth cm	Sand %	Silt %	Clay %	Soil texture USDA***
Tona	0-10	13	67	21	Silt_Loam
	10-20	12	64	23	Silt_Loam
	20-40	12	63	26	Silt_Loam
	40-80	10	68	21	Silt_Loam
	80-100	8.0	64	28	Silty_Clay_Loam
Mas-Badia	0-10	71	17	13	Sandy_loam
	10-20	70	26	4.1	Sandy_loam
	20-40	75	14	10	Sandy_loam
	40-80	75	12	13	Sandy_loam
	80-100	NA	NA	NA	NA

Table 6: Soil physico-chemical properties for the long term field experiments of CS1 (IRTA). For some of the analyses (pH-$CaCl_2$, DON, N-NH_4^+, N-(NO_3^-; NO_2^-), $CaCl_2$-P), the samples from the 0-10 cm and the 10-20 cm layers were pooled prior to measurement. SE : standard error (n = 3).

Site	Treatment	Depth	pH-$CaCl_2$		GW		TC		OC		TN		DON		N-NH_4^+		N-(NO_3^-, NO_2^-)		$CaCl_2$-P		BD	
		cm			%		g kg^{-1}		g kg^{-1}		g kg^{-1}		mg kg^{-1}		mg kg^{-1}		mg kg^{-1}		mg kg^{-1}		g cm^{-3}	
			Mean	SE	Mean	SE	Mean	SE	Mean	SE	Mean	SE	Mean	SE	Mean	SE	Mean	SE	Mean	SE	Mean	SE
Tona	Control	0-10	7.5	0.1	17	0.6	52	0.3	12	0.7	0.2	0.0	4.8	0.5	0.1	0.2	11	1.7	2.4	0.4	1.06	0.08
		10-20			16	1.4	51	0.2	11	0.6	0.1	0.0									1.15	0.05
		20-40	7.5	0.1	11	0.7	49	1.3	8	0.7	0.1	0.0	4.1	0.5	0.7	0.9	12	5.2	1.9	0.7	1.50	0.05
		40-80	-	-	9	0.7	46	0.2	4	0.8	0.1	0.0	-	-	-	-	-	-	-	-	1.56	0.02
		80-100	-	-	11	0.7	45	0.3	3	0.3	0.1	0.0	-	-	-	-	-	-	-	-	1.44	0.07
	Pig slurry	0-10	7.4	0.0	18	0.9	52	0.5	12	1.3	0.1	0.0	4.8	0.4	0.3	0.3	14	5.2	4.0	0.7	1.14	0.11
		10-20			17	0.9	52	0.0	11	0.7	0.1	0.0									1.25	0.08
		20-40	7.6	0.0	12	0.2	49	0.6	8	0.3	0.1	0.0	3.1	0.4	BDL	0.4	7.1	3.0	1.2	0.2	1.45	0.01
		40-80	-	-	7	0.5	47	0.2	4	0.2	0.1	0.0	-	-	-	-	-	-	-	-	1.44	0.03
		80-100	-	-	9	0.5	46	0.1	4	0.2	0.1	0.0	-	-	-	-	-	-	-	-	1.41	0.02
	Pig slurry liquid	0-10	7.3	0.0	15	1.4	51	0.4	12	0.2	0.1	0.0	4.2	0.3	0.4	0.1	15	3.1	4.6	0.5	1.07	0.04
		10-20			14	1.8	51	0.5	11	0.2	0.1	0.0									1.27	0.04
		20-40*	7.6	0.1	11	1.5	49	0.3	10	0.2	0.1	0.0	4.4	0.7	BDL	0.3	17	4.3	2.9	0.4	1.28	0.18
		40-80*	-	-	6	0.2	45	0.8	5	0.3	0.1	0.0	-	-	-	-	-	-	-	-	1.56	0.03
		80-100*	-	-	7	0.8	45	0.2	4	0.5	0.1	0.0	-	-	-	-	-	-	-	-	1.58	0.19
	Pig slurry solid	0-10	7.4	0.0	17	0.3	53	0.7	14	0.5	0.2	0.0	5.2	0.2	1.3	0.7	28	8.8	4.2	0.2	0.98	0.05
		10-20			15	0.5	51	0.5	12	0.5	0.1	0.0									1.27	0.05
		20-40	7.6	0.0	11	0.9	49	0.2	8	0.9	0.1	0.0	4.0	0.9	BDL	0.4	8.0	0.6	1.8	0.2	1.36	0.04
		40-80	-	-	9	0.2	45	0.3	5	0.5	0.1	0.0	-	-	-	-	-	-	-	-	1.48	0.03
		80-100	-	-	10	0.6	45	0.2	4	0.3	0.1	0.0	-	-	-	-	-	-	-	-	1.44	0.06
Mas-Badia	Mineral fertilizer	0-10	7.5	0.0	17	1.2	27	0.7	12	0.3	1.3	0.0	4.9	0.4	0.0	0.3	13	1.2	0.2	0.1	1.19	0.05
		10-20			16	1.2	27	0.7	11	0.7	1.3	0.0									1.35	0.01
		20-40	8.0	0.0	14	0.8	22	0.5	6	0.8	0.8	0.0	4.2	0.2	0.2	0.3	3.4	0.3	0.0	0.0	1.55	0.06
		40-80	-	-	13	2.8	17	2.4	3	0.2	0.4	0.1	-	-	-	-	-	-	-	-	1.61	0.03
		80-100	-	-	13	3.6	21	4.4	3	0.4	0.4	0.1	-	-	-	-	-	-	-	-	1.54	0.08
	Pig slurry	0-10	7.5	0.0	18	0.6	26	0.7	10	0.4	1.2	0.1	4.6	0.2	1.2	0.6	10	1.4	0.1	0.0	1.24	0.08
		10-20			18	0.6	26	0.7	9	0.4	1.1	0.1									1.42	0.05
		20-40	7.8	0.1	16	0.3	23	0.1	6	0.3	0.8	0.1	4.1	0.5	0.4	0.1	4.4	0.4	0.0	0.0	1.55	0.03
		40-80	-	-	18	1.2	22	1.4	3	0.5	0.5	0.0	-	-	-	-	-	-	-	-	1.56	0.06
		80-100	-	-	17	0.4	27	1.0	3	0.4	0.5	0.0	-	-	-	-	-	-	-	-	1.53	0.03
	Biogas digestate	0-10	7.5	0.0	18	0.9	27	0.8	11	0.9	1.3	0.1	5.4	0.0	0.5	0.5	10	1.1	0.2	0.1	1.29	0.03
		10-20			17	0.7	26	0.6	10	0.7	1.2	0.1									1.48	0.04
		20-40	7.9	0.1	14	1.5	22	1.5	6	1.0	0.7	0.1	4.1	0.5	0.7	0.5	3.1	0.4	0.0	0.0	1.55	0.02
		40-80	-	-	14	3.0	18	3.5	2	0.6	0.4	0.1	-	-	-	-	-	-	-	-	1.57	0.09
		80-100	-	-	14	4.5	19	4.6	3	0.7	0.3	0.1	-	-	-	-	-	-	-	-	1.60	0.06

*No samples for one of the replicate; GW : gravimetric water content; TC : total carbon content; OC : organic carbon content; TN : total nitrogen content; Nts : Dissolved organic nitrogen content ; N-NH_4^+ : Ammonium content; P-PO_4 : Phosphorus content in form of phosphate; BD : Bulk density; BDL : below the detection limit

Table 7: Soil biological properties for the long term field experiment of CS1 (IRTA). SE : standard error (n = 3). BDL stands for below the detection limit.

Site	Treatment	Depth	$N_{mineralisable}$		Nmic		Cmic	
		cm	mg kg^{-1}		mg kg^{-1}		mg kg^{-1}	
			Mean	SE	Mean	SE	Mean	SE
Tona	Control	0-10	BDL	-	43	5.7	293	21
	Pig slurry	0-10	BDL	-	40	1.0	277	25
	Pig slurry liquid	0-10	BDL	-	35	0.6	237	25
	Pig slurry solid	0-10	BDL	-	44	0.9	310	7
Mas-Badia	Mineral fertilizer	0-10	7.3	18	41	1.9	296	33
	Pig slurry	0-10	BDL	-	40	2.2	212	26
	Biogas digestate	0-10	BDL	-	40	1.2	220	15

BDL : below the detection limit

Table 8: Soil texture at the long term field experiment of CS2 (IASP).

Depth	Sand	Silt	Clay	Soil texture USDA***
cm	%	%	%	
0-10	69	19	11	Sandy_loam
10-20	73	17	10	Sandy_loam
20-40	75	16	10	Sandy_loam
40-80	65	24	11	Sandy_loam
80-100	55	24	21	Sandy_clay_loam

***Measurement on one replicate

Table 9: Soil physico-chemical properties for the long term field experiment of CS2 (IASP). For some of the analyses (pH-$CaCl_2$, DON, N-NH_4^+, N-(NO_3^-; NO_2^-), $CaCl_2$-P), the samples from the 0-10 cm and the 10-20 cm layers were pooled prior to measurement. SE : standard error (n = 4).

Treatment	Depth	pH-$CaCl_2$		GW		TC		OC		TN		DON		N-NH_4^+		N-(NO_3^-, NO_2^-)		$CaCl_2$-P		BD	
	cm			%		g kg^{-1}		g kg^{-1}		g kg^{-1}		mg kg^{-1}		mg kg^{-1}		mg kg^{-1}		mg kg^{-1}		g cm^{-3}	
		Mean	SE	Mean	SE	Mean	SE	Mean	SE	Mean	SE	Mean	SE	Mean	SE	Mean	SE	Mean	SE	Mean	SE
Control	0-10	5.7	0.2	12	0.5	7.1	0.4	7.1	0.4	0.7	0.0	3.3	0.2	1.2	0.7	5.8	0.7	4.5	0.4	1.70	0.07
	10-20			10	0.3	6.6	0.3	6.6	0.3	0.6	0.0									1.82	0.03
	20-40	5.9	0.3	9	0.4	4.6	0.2	4.6	0.2	0.5	0.0	2.8	0.3	0.3	0.1	2.9	0.4	4.8	0.3	1.77	0.03
	40-80	-	-	8	1.3	1.8	0.8	1.3	0.4	0.2	0.1	-	-	-	-	-	-	-	-	1.78	0.03
	80-100	-	-	9	1.3	4.4	3.2	1.1	0.2	0.2	0.0	-	-	-	-	-	-	-	-	1.90	0.06
Mineral fertilizer	0-10	4.9	0.1	12	0.5	7.1	0.2	7.0	0.2	0.7	0.0	5.1	0.2	1.7	0.7	8.0	0.8	4.7	0.4	1.57	0.08
	10-20			10	0.3	6.1	0.2	6.0	0.2	0.6	0.0									1.77	0.03
	20-40	5.8	0.1	8	0.2	3.9	0.4	3.8	0.4	0.4	0.0	2.7	0.3	0.3	0.2	10.9	3.3	3.6	0.5	1.68	0.04
	40-80	-	-	8	0.8	2.0	0.7	1.9	0.7	0.2	0.1	-	-	-	-	-	-	-	-	1.73	0.07
	80-100	-	-	8	1.1	1.9	0.9	1.8	0.9	0.3	0.1	-	-	-	-	-	-	-	-	1.72	0.14
Manure	0-10	5.7	0.3	12	0.5	8.9	0.6	8.8	0.6	0.8	0.0	4.7	0.4	2.5	1.6	10.2	2.2	5.9	1.0	1.54	0.06
	10-20			10	0.4	6.5	0.2	6.3	0.2	0.7	0.0									1.81	0.02
	20-40	6.1	0.3	9	0.4	5.0	0.4	4.8	0.4	0.5	0.0	3.7	0.0	0.7	0.5	9.6	2.8	3.9	0.6	1.70	0.02
	40-80	-	-	8	1.2	1.4	0.3	1.3	0.3	0.2	0.0	-	-	-	-	-	-	-	-	1.75	0.03
	80-100	-	-	7	1.0	3.6	2.9	0.9	0.3	0.1	0.0	-	-	-	-	-	-	-	-	1.79	0.08
Digestate cattle slurry	0-10	5.5	0.2	13	0.7	9.2	0.3	9.1	0.4	0.8	0.0	4.6	0.3	0.8	0.0	6.4	0.6	6.4	0.8	1.56	0.07
	10-20*			10	0.3	6.8	0.2	6.8	0.2	0.7	0.0									1.73	0.02
	20-40	5.9	0.2	9	0.2	5.5	0.3	5.4	0.3	0.6	0.0	3.5	0.2	0.2	0.2	4.5	0.2	3.9	0.3	1.79	0.02
	40-80	-	-	8	1.3	5.8	4.1	1.7	0.2	0.2	0.0	-	-	-	-	-	-	-	-	1.86	0.05
	80-100	-	-	10	1.2	9.2	4.7	1.7	0.2	0.2	0.0	-	-	-	-	-	-	-	-	1.83	0.02
Digestate liquid	0-10	5.9	0.2	13	0.4	8.4	0.3	0.8	0.0	8.5	0.3	4.3	0.3	0.9	0.2	8.7	0.9	7.0	0.7	1.57	0.06
	10-20			10	0.3	4.4	1.5	5.8	0.0	0.6	0.0									1.79	0.01
	20-40	5.9	0.3	9	0.1	4.8	0.2	4.6	0.2	0.5	0.0	3.1	0.3	0.3	0.1	5.1	1.0	5.5	0.8	1.75	0.04
	40-80	-	-	7	1.1	1.7	0.2	1.6	0.2	0.2	0.0	-	-	-	-	-	-	-	-	1.75	0.03
	80-100	-	-	7	1.3	3.7	2.7	1.3	0.4	0.2	0.0	-	-	-	-	-	-	-	-	1.80	0.04
Digestate solid	0-10	5.4	0.2	13	0.7	8.8	0.2	8.8	0.2	0.8	0.0	5.3	0.3	1.1	0.3	9.3	1.4	7.6	0.8	1.55	0.03
	10-20			10	0.6	6.9	0.2	6.8	0.2	0.7	0.0									1.75	0.04
	20-40	5.8	0.2	9	0.4	4.7	0.3	4.7	0.4	0.5	0.0	3.4	0.3	0.7	0.2	5.5	0.3	4.3	0.2	1.78	0.05
	40-80	-	-	7	0.4	3.4	2.4	1.3	0.4	0.2	0.0	-	-	-	-	-	-	-	-	1.76	0.03
	80-100	-	-	10	1.3	4.8	3.5	1.3	0.2	0.2	0.0	-	-	-	-	-	-	-	-	1.75	0.04

total nitrogen content; Nts : Dissolved organic nitrogen content ; N-NH_4^+ : Ammonium content; P-PO_4 : Phosphorus content in form of phosphate; BD : Bulk density

Table 10: Soil biological properties for the long term field experiment of CS2 (IASP). SE : standard error (n = 4).

Treatment	Depth	$N_{mineralisable}$		Nmic		Cmic	
	cm	mg kg^{-1}		mg kg^{-1}		mg kg^{-1}	
		Mean	SE	Mean	SE	Mean	SE
Control	0-10	8.9	0.6	10	0.5	45	6.0
Mineral fertilizer	0-10	8.7	0.5	8	0.9	52	9.6
Manure	0-10	5.7	0.3	12	0.5	8.9	0.6
Digestate cattle slurry	0-10	8.7	1.0	11	1.1	50	7.7
Digestate liquid	0-10	7.9	1.6	12	1.4	39	4.7
Digestate solid	0-10	5.7	2.1	12	1.8	64	10

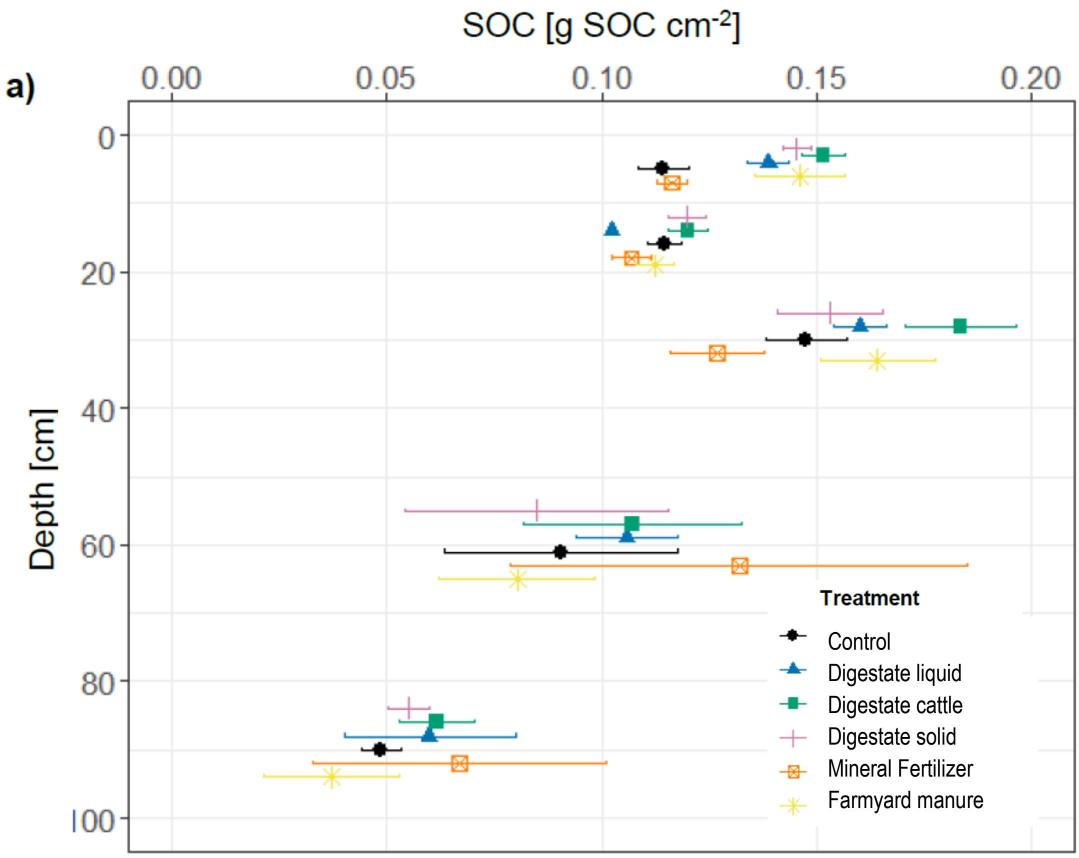

Figure 3: Soil organic carbon (SOC) stocks from each treatment at CS2 (Germany sites over 5 depths (0-10 cm, 10-20 cm, 20-40 cm, 40-80 cm, and 80-100 cm). Error bars represent ± standard error of the mean of four field replicates.

5. Baseline results for the newly started experiments (CS4, CS5)

Overall, the two experimental sites CS4.1 (Corregio) and CS4.2 (Parma) presented similar soil properties, with dominantly clay soil textures along the soil profile (**Table 11**). The pH values were higher in CS4.1 compared with C4.2 in the first 40 cm soil layer (7.5 versus 5.7-5.8), which was related to the higher inorganic carbon content (TC-OC) in CS4.1 (**Table 12**). While the inorganic nitrogen content (N-NH_4^+; N-(NO_3^-; NO_2^-)) was similar at both sites, the DON content was contrasted for CS4.1 and C4.2 (29 versus 3 mg kg^{-1} in the first 20 cm).

Table 11 : Soil physical properties prior to the application of treatments (baseline) at CS4 (FCSR). SE : standard error (n = 5).

	Depth (cm)	BD ($g\ cm^{-3}$) Mean	BD SE	Sand (%)	Silt (%)	Clay (%)	Soil texture USDA***
Corregio	0-10	1.51	0.06	26	31	42	Clay
	10-20	1.55	0.04	26	37	37	Clay_loam
	20-40	1.63	0.04	24	32	44	Clay
	40-80	1.64	0.02	23	31	46	Clay
	80-100	1.70	0.06	13	59	29	Slity_clay_loam
Parma	0-10	1.07	0.05	25	5	70	Clay
	10-20	1.15	0.05	21	31	48	Clay
	20-40	1.23	0.10	24	30	45	Clay
	40-80*	0.89	0.09	24	21	55	Clay
	80-100**	1.42	0.33	40	19	41	Clay

*For three of the replicates, the below depth limit was above 80 cm; **No samples for three of the replicates; ***Measurement on one replicate; BD : Bulk density

Table 12 : Soil chemical properties prior to the application of treatments (baseline) at CS4 (FCSR). SE : standard error (n = 5). For some of the analyses (pH-$CaCl_2$, DON, N-NH_4^+, N-(NO_3^-; NO_2^-), $CaCl_2$-P), the samples from the 0-10 cm and the 10-20 cm layers were pooled prior to measurement.

	Depth	pH-$CaCl_2$		GW		TC		OC		TN		DON		N-NH_4^+		N-(NO_3^-, NO_2^-)		$CaCl_2$-P	
	cm			%		g kg^{-1}		g kg^{-1}		g kg^{-1}		mg kg^{-1}		mg kg^{-1}		mg kg^{-1}		mg kg^{-1}	
		Mean	SE	Mean	SE	Mean	SE	Mean	SE	Mean	SE	Mean	SE	Mean	SE	Mean	SE	Mean	SE
Corregio	0-10	7.5	0.1	17	0.1	16	1.2	11	0.5	1.3	0.1	29	13.1	BDL	0.2	27	13.8	0.3	0.1
	10-20			17	0.7	18	2.8	9	1.3	1.2	0.2								
	20-40	7.5	0.1	16	0.3	19	2.9	10	1.4	1.2	0.2	15	3.9	BDL	0.2	12	3.5	0.5	0.2
	40-80	-	-	16	0.7	22	2.8	7	1.0	0.9	0.1	-	-	-	-	-	-	-	-
	80-100	-	-	17	0.2	25	1.3	7	1.8	0.8	0.2	-	-	-	-	-	-	-	-
Parma	0-10	5.7	0.1	16	0.6	14	0.8	13	0.9	1.5	0.1	3	0.1	0.7	0.2	23	7.2	0.4	0.1
	10-20			14	0.8	13	0.5	12	0.5	1.4	0.0								
	20-40	5.8	0.2	14	0.7	11	0.8	10	0.9	1.3	0.1	5	0.7	BDL	0.2	3	0.4	0.2	0.0
	40-80*	-	-	16	0.6	7	0.9	6	0.9	0.9	0.1	-	-	-	-	-	-	-	-
	80-100**	-	-	20	1.3	5	1.2	5	1.2	0.7	0.1	-	-	-	-	-	-	-	-

*For three of the replicates, the below depth limit was above 80 cm; **No samples for three of the replicates; GW : gravimetric water content; TC : total carbon content; OC : organic carbon content; TN : total nitrogen content; Nts : Dissolved organic nitrogen content ; N-NH_4^+ : Ammonium content; P-PO_4 : Phosphorus content in form of phosphate; BDL : below the detection limit

Table 13 : Soil biological properties prior to the application of treatments (baseline) at CS4 (FCSR). SE : standard error (n = 5).

	Depth	$N_{mineralisable}$		Nmic		Cmic	
	cm	mg kg^{-1}		mg kg^{-1}		mg kg^{-1}	
		Mean	SE	Mean	SE	Mean	SE
Corregio	0-10	12	0.7	13	1.7	76	7
Parma	0-10	10	0.6	17	5.1	118	28

The **tables 14**, **15** and **16** highlight the physical, chemical and biological characteristics of the soil at CS6. The experimental site CS6 presented a sandy clay loam texture (**Table 14**) with a mean pH-value of 5.0 (**Table 15**). The OC content was low, even in the top 10 cm soil layer (19 g kg^{-1}).

Table 14 : Soil physical properties prior to the application of treatments (baseline) at the CS6 (ASIO). SE : standard error (n = 4).

Depth	BD		Sand	Silt	Clay	Soil texture USDA***
cm	g cm^{-3}		%	%	%	
	Mean	SE				
0-10	1.06	0.09	57	17	26	Sandy_clay_loam
10-20	1.41	0.12	59	25	15	Sandy_loam
20-40	1.24	0.14	63	15	22	Sandy_clay_loam
40-80*	NA	-	85	6	9	Lomy_sand
80-100**	1.15	0.09	91	3	6	Sand

*For three of the replicates, below depth limit was above 80 cm;
**Only one replicate measured; ***Measurement on one replicate;
BD : Bulk density; NA : not available

Table 15 : Soil chemical properties prior to the application of treatments (baseline) at the CS6 (ASIO). SE : standard error (n = 4).

Depth	pH-$CaCl_2$		GW		TC		OC		TN		DON		N-NH_4^+		N-(NO_3^-, NO_2^-)		$CaCl_2$-P	
cm			%		g kg^{-1}		g kg^{-1}		g kg^{-1}		mg kg^{-1}		mg kg^{-1}		mg kg^{-1}		mg kg^{-1}	
	Mean	SE	Mean	SE	Mean	SE	Mean	SE	Mean	SE	Mean	SE	Mean	SE	Mean	SE	Mean	SE
0-10	5.0	0.1	9.4	0.8	19	2.0	18	2.0	1.9	0.3	8.4	1.4	2.3	0.4	65	17	7.2	2.6
10-20			8.3	0.2	12	0.9	11	1.0	1.1	0.1								
20-40	5.1	0.1	8.7	0.5	11	0.8	11	0.7	1.0	0.1	3.8	0.3	0.9	0.2	46	24	0.7	0.1
40-80*	-	-	3.9	0.4	5	1.3	5	1.2	0.5	0.1	-	-	-	-	-	-	-	-
80-100**	-	-	1.6	-	1	-	0	-	0.1	-	-	-	-	-	-	-	-	-

*For three of the replicates, below depth limit was above 80 cm; **Only one replicate measured; GW : gravimetric water content; TC : total carbon content; OC : organic carbon content; TN : total nitrogen content; Nts : Dissolved organic nitrogen content ; N-NH_4^+ : Ammonium content; P-PO_4 : Phosphorus content in form of phosphate

Table 16 : Soil biological properties prior to the application of treatments (baseline) at the CS6 (ASIO). SE : standard error (n = 4).

Depth	$N_{mineralisable}$		Nmic		Cmic	
cm	mg kg^{-1}		mg kg^{-1}		mg kg^{-1}	
	Mean	SE	Mean	SE	Mean	SE
0-10	5.0	0.1	9.4	0.8	19	2.0

6. Future goals

6.1. Next sampling campaign

For the long term experiments of CS1 (IRTA) and CS2 (IASP), as well as for the on-farm experiment (CS3, AREC), we do not expect any significant changes to be observed since the sampling in 2019. Thus, these experiments will not be additionally sampled in 2021. In early 2021, WUR and TUM will work together with the respective case study leaders, to valorize the above-mentioned results (section 3. and 4.) into peer-reviewed publications.

The CS4 located in Parma aims at comparing the conservation tillage practices compared with the conventional tillage. As the deliverable 1.3 aims at assessing the effect of novel amendments on elemental soil cycles, it was decided in consortium with WUR, TUM and the case study leader, to not sample this experiment in 2021. Thus, in September 2021, the sampling of CS4 will exclusively focus on the experiment site of Corregio which aims at comparing the effect of microfiltered digestate compared with conventional mineral fertilizers on elemental soil cycles. Regarding the CS6 in Czech Republic (ASIO), it was decided, after discussing the data need with the case study leader, that there will be no additional sampling in 2021 at this site.

In addition to the already sampled long term field experiments in CS1, the WUR and TUM decided to sample an additional experiment from the IRTA group in fall 2021. In October 2019, IRTA has established a new experiment in Lleda to explore the effect of biogas fertilizers on soil and plant properties. This new experiment will complement the results obtained on the effect of biodigestate fertilizers on soil properties from the long-term experiments on CS1.2 and CS2.

As described in section 1.1., the baseline sampling of the experiments established in CS2 (Brandenburg) and CS5 (Gelderland), planned in spring 2020, have been cancelled. The Pondus products (consisting of a digestate, ammonium sulfate as well as a rest-product) have been produced and applied in September 2020 and will be applied again in April 2021 on the experimental sites of CS2 and CS5, respectively. A team from WUR § TUM, together with the leaders of the case studies, will sample all the treatments in September 2021, in order to study the effect of Pondus treatment on soil properties and carbon, nitrogen and phosphorus cycling across sites.

It is estimated that WUR and TUM will collect 430 disturbed samples (including all treatments, replicates and depths) for bulk soil analyses and 60 core samples kept undisturbed for hyperspectral imaging (**Table 17**).

Table 17 : Planned sampling in September 2021 and fall 2021.

Case study	Sampling time	Sub-sites	Type of sampling	Estimated number of samples for bulk analyses	Estimated of core samples for hyperspectral imaging
CS1 Catalonia, Spain	Fall 21	Lleda (CS1.3)	Biogas	60	12
CS2 Brandenburg, Germany	09/21		Pondus	120	18
CS4 Emilia-Romagna, Italy	09/21	Correggio (CS4.2)	Microfiltered fertilizers	75	9
CS5 Gelderland, The Netherlands	09/21		Pondus	175	21
			Total	**430**	**60**

6.2. Analyses in progress and future analyses

In 2021, before the second sampling in September and fall 2021, the WUR and TUM will actively proceed with the remaining analyses to characterize the bulk soil properties at the necessary case studies. This includes, as described in the section 2.1 and 2.3, the P-Olsen and the Mehlich3-P analyses, as well as the remaining soil texture analyses. Some additional analyses are currently performed on the long-term experiment of CS1.1 and the CS2. The decision for these additional analyses was based on the soil organic carbon stocks, leading to decide us to further explore the soil physico-chemical properties on some selected samples. For this purpose, the TUM&WUR team is currently applying wet sieving in order to obtain aggregate size distribution, as well as organic carbon and nitrogen contents and allocation within these aggregates. With these additional analyses, we will be able to further explain the contrasting fertilizer effects observed on SOC stocks in CS1.1 and CS2. In parallel, the TUM&WUR team will continue working on modelling the spatial distribution of the C and N content in the soil profile using hyperspectral imaging.

After the second soil sampling, the WUR and TUM will proceed the samples collected following the same protocols used for the first sampling campaign and detailed in the deliverable 1.1. We will thus be able to present the effect of the novel amendments on soil physical, chemical and biological properties in the deliverable 1.3.