ESI 1 Chemical and mineralogical properties of the soils prior to the γ-irradiation and the growth experiment.

ESI 2 Mean concentrations of water-soluble major elements (standard deviation in parentheses) in soils A and F before and after the growth experiment for the intact (IN) and sterilized-reinoculated (SR) materials, of the bulk (Bk) and the rhizosphere (Rz) components. The Wilcoxon test indicates the significance of the differences between the Bk and the Rz soils for a given soil and treatment (ns and * represent a $p > 0.10$ and $p \leq 0.10$ respectively).

ESI 3 Mean concentrations of water-soluble Al, Cu and Zn species (standard deviation in parentheses) in soils A and F before and after the growth experiment for the intact (IN) and sterilized-reinoculated (SR) materials of the bulk (Bk) and the rhizosphere (Rz) components. The Wilcoxon test indicates the significance of the differences between the Bk and the Rz soils for a given soil and treatment (ns and * represent a $p > 0.10$ and $p \leq 0.10$ respectively).

ESI 4 Mean concentrations of water-soluble trace elements (standard deviation in parentheses) in soils A and F before and after the growth experiment for the intact (IN) and sterilized-reinoculated (SR) materials, of the bulk (Bk) and the rhizosphere (Rz) components. The Wilcoxon test indicates the significance of the differences between the Bk and the Rz soils for a given soil and treatment (ns and * represent a $p > 0.10$ and $p \leq 0.10$ respectively).

ESI 5 Mean concentration of NH4-EDTA soluble trace elements (standard deviation in parentheses) in soils A and F for the intact (IN) and sterilized-reinoculated (SR) materials, of the bulk (Bk) and the rhizosphere (Rz) components. The Wilcoxon test indicates the significance of the differences between the Bk and the Rz soils for a given soil and treatment (ns and * represent a $p > 0.10$ and $p \leq 0.10$ respectively).

ESI 1

				Pyro[d]		Oxa[d]		DC[d]	Mineralogy of the clay fraction ≤ 2 µm[e]							
	CEC[a]	BS[b]	Zn_{ex}/CEC[c]	Fe	Al	Fe	Al	Fe	Qtz	Chl	Chl-Vermi	K-Feld	Plag	Mica	Amphi	Vermi
Soil	cmol(+)/kg	%	%	g/kg					relative abundance[f]							
A	4.3	53	23	2.6	2.4	6.9	4.6	9.8	4	3	3	2	2	1	1	---
F	17.9	92	7	4.6	2.1	4.6	2.2	16.7	4	3	3	2	2	1	1	1

[a] CEC = cation-exchange capacity as the sum of $BaCl_2$-exchangeable cations
[b] BS = base saturation
[c] Zn_{ex}/CEC = exchangeable zinc saturation computed as exchangeable Zn (Zn_{ex}) divided by CEC
[d] Pyro = sodium pyrophosphate; Oxa = acid ammonium oxalate; DC = dithionite-citrate extractions
[e] Qtz = quartz; Chl = chlorite; Chl-Vermi = chlorite-vermiculite interstratified; K-Feld = K-feldspath; Plag = plagioclase; Amphi = amphibole; Vermi = vermiculite;
[f] 4 = dominant; 3 = major; 2 = minor and 1 = trace

ESI 2

Soil	Treatment[a]	Component	n[b]	EC[c]	H^+	Ca	Mg	Na	NH_4	K	Cl	NO_3	SO_4	Tot N[c]	DON[c]	DOC[c]
				µS/cm	µM	----------µmol/kg soil----------										
A	***Before growth experiment***															
	Initial		1	77	6.2	998	148	252	2677	807	274	220	446	120	79	532
				(4)	(0.4)	(105)	(5)	(10)	(297)	(20)	(6)	(10)	(24)	(1)	(4)	(28)
	Sterilized		1	85	15.6	2160	274	195	485	943	157	402	298	50	38	547
				(8)	(1.2)	(72)	(29)	(7)	(42)	(73)	(4)	(51)	(22)	(1)	(1)	(69)
	After growth experiment															
	IN	**Bk**	4	90ns	12ns	2071ns	248ns	185ns	163ns	848ns	102ns	7367ns	248ns	8234ns	259ns	9093ns
				(10)	(2)	(200)	(34)	(24)	(24)	(41)	(23)	(1287)	(12)	(1880)	(3)	(1166)
		Rz	3	107	13	2203	315	368	259	1360	142	8354	137	9265	652	7835
				(2)	(1)	(174)	(7)	(6)	(11)	(26)	(3)	(41)	(15)	(76)	(50)	(178)
	SR	**Bk**	4	132ns	15ns	2839ns	354ns	235ns	287ns	1266ns	100ns	10407ns	222ns	11439ns	745ns	7892ns
				(12)	(1)	(156)	(24)	(26)	(41)	(145)	(11)	(790)	(13)	(945)	(465)	(334)
		Rz	3	147	18	3318	408	326	305	1188	207	12043	139	12545	197	9190
				(1)	(0.2)	(318)	(15)	(5)	(4)	(8)	(4)	(90)	(5)	(110)	(89)	(1472)
F	***Before growth experiment***															
	Initial		1	102	1.1	2809	821	368	2245	987	216	603	273	157	117	924
				(1)	(0.1)	(108)	(13)	(5)	(28)	(3)	(8)	(21)	(7)	(7)	(6)	(52)
	Sterilized		1	117	2.1	1679	1729	271	50	1144	154	622	204	114	104	957
				(3)	(0.2)	(179)	(88)	(10)	(41)	(16)	(19)	(84)	(6)	(8)	(7)	(86)
	After growth experiment															
	IN	**Bk**	4	98*	1.8*	818*	1197*	78*	101ns	860*	64*	6130*	627*	10285ns	4056*	24429*
				(12)	(0.1)	(73)	(181)	(14)	(54)	(29)	(38)	(934)	(66)	(1204)	(1602)	(286)
		Rz	4	168	1.0	1226	2422	772	71	272	138	10090	1886	12209	2049	27480
				(19)	(0.2)	(103)	(267)	(108)	(23)	(77)	(65)	(1660)	(244)	(2317)	(643)	(1490)
	SR	**Bk**	4	147*	2.1*	1214ns	1876*	111*	130*	859*	81ns	11004ns	595*	12267ns	1493ns	24462*
				(12)	(0.2)	(80)	(199)	(20)	(24)	(50)	(9)	(1130)	(78)	(1245)	(510)	(515)
		Rz	4	172	1.5	1270	2486	648	146	72	51	10064	2582	11457	1248	34282
				(9)	(0.1)	(50)	(164)	(101)	(20)	(27)	(33)	(938)	(596)	(1216)	(355)	(2188)
	dlm[d]			1.0	0.01	10	5	10	10	10	10	10	10	15	25	20

[a] Initial = initial soil; Sterilized = 100% sterilized soil; IN = intact non sterilized soil; SR = sterilized-reinoculated soil

[b] For n = 1, the standard deviations are estimated from analytical replication

[c] EC = electrical conductivity; Tot N = total soluble nitrogen; DON = dissolved organic nitrogen; DOC = dissolved organic carbon

[d] dlm = detection limit of the method

ESI 3

Soil	Treatment[a]	Component	n[b]	Al		Al $_{tm}$[c]		Al $_{om}$[c]		Al $_{im}$[c]		Cu		Cu^{2+}		Zn		ZnL[c]	
				µmol/kg soil															
A	***Before growth experiment***																		
	Initial		1	186 (6.2)		---		---		---		1.25 (0.03)		---		38.6 (0.8)		---	
	Sterilized		1	268 (36.2)		---		---		---		0.94 (0.16)		---		75.9 (10.1)		---	
	After growth experiment																		
	IN	**Bk**	4	152	ns	92.8	ns	35.3	ns	57.5	ns	0.65	ns	0.45	ns	106	ns	92	ns
				(3.2)		(6.0)		(0.2)		(6.3)		(0.03)		(0.03)		(10.3)		(8.2)	
		Rz	3	119		109.5		35.6		73.6		0.47		0.31		127		99	
				(8.3)		(0.9)		(0.1)		(2.5)		(0.01)		(0.03)		(3.3)		(3.2)	
	SR	**Bk**	4	170	ns	126.7	ns	35.2	ns	91.5	ns	0.51	ns	0.36	ns	160	ns	130	ns
				(11.0)		(11.3)		(1.3)		(11.9)		(0.02)		(0.03)		(16.1)		(11.6)	
		Rz	3	152		149.9		35.6		114.3		0.48		0.44		189		139	
				(1.9)		(1.4)		(1.8)		(3.0)		(0.01)		(0.02)		(3.2)		(4.4)	
F	***Before growth experiment***																		
	Initial		1	154 (3.8)		---		---		---		2.09 (0.01)		---		169 (3.8)		---	
	Sterilized		1	189 (6.5)		---		---		---		1.85 (0.03)		---		313 (28.6)		---	
	After growth experiment																		
	IN	**Bk**	4	118	*	38.5	*	30.2	*	8.4	ns	1.22	*	0.11	*	202	ns	137	ns
				(9.7)		(0.8)		(2.0)		(1.4)		(0.04)		(0.02)		(14.9)		(17.1)	
		Rz	4	70		32.2		24.3		7.9		1.31		0.07		190		122	
				(8.1)		(4.6)		(2.5)		(2.4)		(0.06)		(0.01)		(38.8)		(32.2)	
	SR	**Bk**	4	100	*	36.9	*	29.0	*	7.9	*	1.13	*	0.07	ns	223	*	161	*
				(6.7)		(0.9)		(2.3)		(1.7)		(0.02)		(0.02)		(11.5)		(5.4)	
		Rz	4	92		47.8		35.7		12.2		1.42		0.08		256		176	
				(1.9)		(6.1)		(3.1)		(3.1)		(0.02)		(0.01)		(11.0)		(12.0)	
dlm[d]				0.12		0.01		0.01		0.01		0.02		0.03		0.03		0.02	

[a] Initial = initial soil; Sterilized = 100% sterilized soil; IN = intact non sterilized soil; SR = sterilized-reinoculated soil
[b] For n = 1, the standard deviations are estimated from analytical replication
[c] Al tm, Al om, Al im: total monomeric, organic and inorganic monomeric aluminum; ZnL : labile Zn
[d] dlm = detection limit of the method

ESI 4

Soil	Treatment[a]	Component	n[b]	As		Cd		Ce		Cr		Fe		Pb		Tl	
				µmol/kg soil													
A	*Before growth experiment*																
	Initial		1	0.135		0.12		0.114		0.23		24.8		0.038		0.002	
				(0.001)		(0.01)		(0.004)		(0.01)		(4.3)		(0.022)		(0.002)	
	Sterilized		1	0.100		0.28		0.107		0.25		21.9		0.078		0.003	
				(0.009)		(0.04)		(0.019)		(0.04)		(2.7)		(0.012)		(0.002)	
	After growth experiment																
	IN	**Bk**	4	0.095	ns	0.27	ns	0.072	ns	0.16	ns	18.7	ns	0.028	ns	0.0026	ns
				(0.004)		(0.04)		(0.002)		(0.02)		(1.8)		(0.004)		(0.0007)	
		Rz	3	0.076		0.30		0.058		0.14		16.3		0.033		0.0032	
				(0.003)		(0.01)		(0.003)		(0.01)		(0.2)		(0.001)		(0.0002)	
	SR	**Bk**	4	0.092	ns	0.43	ns	0.069	ns	0.13	ns	16.7	ns	0.028	ns	0.0033	ns
				(0.006)		(0.04)		(0.003)		(0.01)		(1.1)		(0.002)		(0.0002)	
		Rz	3	0.073		0.47		0.059		0.11		12.0		0.030		0.0038	
				(0.004)		(0.01)		(0.001)		(0.01)		(1.6)		(0.001)		(0.001)	
F	*Before growth experiment*																
	Initial		1	0.457		0.41		0.092		0.23		56.1		0.035		0.004	
				(0.005)		(0.05)		(0.007)		(0.01)		(3.2)		(0.002)		(0.001)	
	Sterilized		1	0.384		0.55		0.085		0.23		48.3		0.042		0.004	
				(0.032)		(0.06)		(0.005)		(0.03)		(0.4)		(0.001)		(0.001)	
	After growth experiment																
	IN	**Bk**	4	0.327	*	0.33	ns	0.062	*	0.11	*	26.4	*	0.027	*	0.0025	*
				(0.001)		(0.03)		(0.005)		(0.01)		(2.9)		(0.006)		(0.0001)	
		Rz	4	0.231		0.35		0.052		0.09		19.9		0.017		0.0022	
				(0.016)		(0.05)		(0.003)		(0.01)		(1.4)		(0.003)		(0.0002)	
	SR	**Bk**	4	0.320	*	0.43	ns	0.058	*	0.11	ns	20.3	ns	0.025	ns	0.0027	ns
				(0.011)		(0.04)		(0.004)		(0.01)		(3.1)		(0.003)		(0.0003)	
		Rz	4	0.245		0.47		0.065		0.11		22.6		0.024		0.0025	
				(0.011)		(0.03)		(0.005)		(0.01)		(1.1)		(0.003)		(0.0006)	
dlm[c]				0.032		0.005		0.004		0.020		0.306		0.007		0.001	

[a] Initial = initial soil; Sterilized = 100% sterilized soil; IN = intact non sterilized soil; SR = sterilized-reinoculated soil

[b] For n = 1, the standard deviations are estimated from analytical replication

[c] dlm = detection limit of the method

ESI 5

Soil	Treatment[a]	Component	n	Al		As		Cd		Ce		Cr		Cu		Pb		Zn	
				µmol/kg															
A	**IN**	**Bk**	4	18310	ns	< dlm		4.49	ns	14.1	ns	1.10	ns	29.3	ns	25.4	ns	892	ns
				(152)				(0.12)		(0.4)		(0.21)		(0.31)		(0.7)			
		Rz	3	18580		< dlm		4.56		14.2		1.25		31.9		58.8		873	
				(56)				(0.04)		(0.1)		(0.02)		(0.79)		(0.5)			
	SR	**Bk**	4	18162	ns	< dlm		4.54	ns	14.2	ns	1.12	ns	29.6	ns	25.6	ns	914	ns
				(252)				(0.12)		(0.4)		(0.10)		(1.01)		(0.6)			
		Rz	3	18736		< dlm		4.65		14.6		1.23		31.6		28.7		876	
				(111)				(0.05)		(0.1)		(0.08)		(0.31)		(0.4)			
F	**IN**	**Bk**	4	10192	*	1.73	*	52.9	ns	27.3	*	3.08	*	114.1	*	113.1	*	11980	ns
				(289)		(0.13)		(1.4)		(1.4)		(0.19)		(3.5)		(5.0)			
		Rz	4	10741		2.00		55.0		28.5		4.23		127.6		115.7		11917	
				(374)		(0.13)		(3.3)		(1.2)		(0.38)		(6.3)		(4.6)			
	SR	**Bk**	4	10492	*	1.87	ns	52.9	ns	38.6	ns	3.46	*	115.8	*	115.8	*	12049	ns
				(419)		(0.13)		(1.9)		(0.9)		(0.38)		(4.7)		(2.6)			
		Rz	4	18868		1.60		53.6		29.3		4.42		124.9		119.0		11962	
				(336)		(0.13)		(1.7)		(0.7)		(0.58)		(3.1)		(1.9)			
dlm[b]				7.41		0.53		0.02		0.14		0.38		3.1		0.05		1.53	

[a] Initial = initial soil; Sterilized = 100% sterilized soil; IN = intact non sterilized soil; SR = sterilized-reinoculated soil

[b] dlm = detection limit of the method