Table S1. Soil types and physicochemical properties stratified by horizon. *WRB - World Reference Base for Soil Resources.

	Horizon	Horizon	Bulk Density	sand	silt	clay	C	N	$CaCO_3$	pH
	(WRB*)	lower depth [cm]	[Mg m^{-3}]	wt.% of humus-/carbonate-free fine-earth (< 2mm)			[%]	g kg^{-1}	[%]	[0.01M $CaCl_2$]
Calcaric Regosol (Rg-ca)	Ap	0 - 26	1.64	60	28	12	0.51	0.62	9.9	7.5
	CBkl1	-48	1.86	61	27	12	0.10	0.15	11.7	7.7
	Bkl1	-85	1.66	61	27	12	0.10	0.19	11.7	7.7
	Bkl2	-200	1.84	61	26	13	0.10	0.15	11.8	7.7
Nudiargic Luvisol (Lv-ng)	Ap	0-31	1.66	59	28	13	0.88	0.80	0.0	7.0
	Btg	-70	1.74	55	27	19	0.37	0.35	0.0	7.2
	CBkg	-105	1.79	59	26	15	0.10	0.18	8.8	7.7
	BCkg	-175	1.87	61	26	13	0.10	0.14	11.1	7.7
Calcic Luvisol (Lv-cc)	Ap	0 - 31	1.63	59	32	9	0.78	0.77	0.0	5.5
	E	-45	1.79	51	39	10	0.30	0.28	0.0	6.2
	Bt/E	-62	1.67	49	35	16	0.30	0.23	0.0	6.4
	Bt1	-90	1.76	50	31	19	0.29	0.28	0.0	6.8
	Bt2	-135	1.73	54	30	16	0.26	0.23	0.0	7.2
	CBkl	-200	1.79	53	34	13	0.10	0.12	12.2	7.5
Gleyic-Colluvic Regosol (Rg-co.gl)	Ap	0 - 31	1.62	63	28	9	1.01	1.07	0.0	5.1
	Ab	-63	1.62	64	29	7	0.54	0.60	0.0	5.9
	2Ah	-85	1.65	57	30	13	0.67	0.58	0.0	6.4
	Bl	-150	1.80	56	29	15	0.22	0.36	0.0	7.0

Table S2. Simulation results of various soil water content scenarios across different soil erosion gradients. Estimation of the root carbon each cultivar was unable to input into the soil due to reduced soil water availability over the past five years.

	Soil water [cm^3 cm^{-3}]	RG-ca	Lv-ng	Lv-cc	Rg-co.gl
		Root biomass [g m^{-2}]			
Ostpreußischer	18.5	208	354	345	279
	21.5	171	357	345	273
	24.3	202	363	350	284
	27	213	363	362	297
	30	219	366	366	306
slope linear regression		2.2	1.1	2.1	2.7
Hadmerslebener	18.5	185	289	330	215
	21.5	181	291	334	211
	24.3	210	292	340	229
	27	252	362	419	293
	30	266	381	418	311
slope linear regression		8.3	8.9	9.1	9.6
Ponticus	18.5	182	320	315	223
	21.5	168	322	317	219
	24.3	198	321	319	226
	27	220	340	350	259
	30	229	346	352	274
slope linear regression		5.1	2.4	3.8	5
		kg C ha^{-1}			
Ostpreußischer		9.41	4.70	8.98	11.54
Hadmerslebener		35.48	38.05	38.90	41.04
Ponticus		21.80	10.26	16.25	21.38

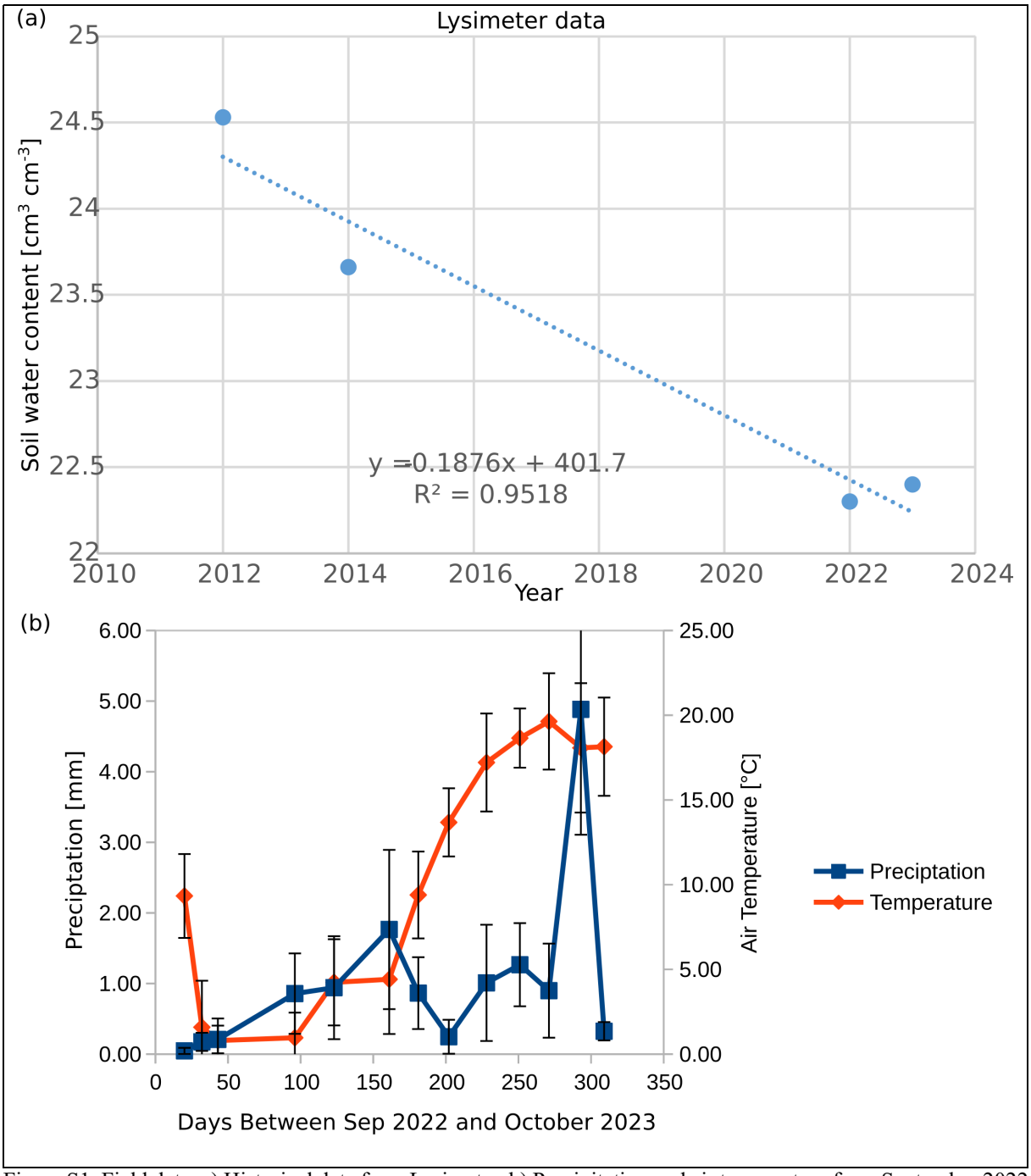

Figure S1. Field data. a) Historical data from Lysimeter. b) Precipitation and air temperature from September 2022 to October 2023.

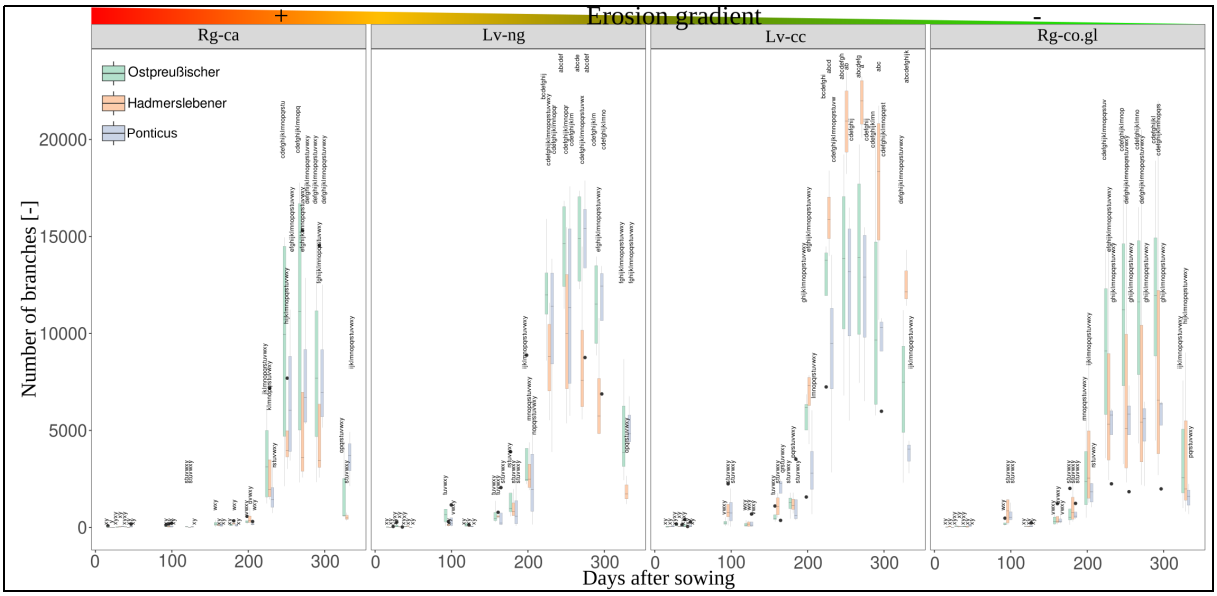

Figure S2. Number of root branches (-) evolution for the three wheat cultivars (Ostpreußischer, Hadmerslebener, and Ponticus) under different soil erosional status: Calacric Regosol (RG-ca), Nudiargic Luvisol (LV-ng), Calcic Luvisol (LV-cc) and Gleyic-Colluvic Regosol (RG-co.gl). The letters above the boxplots indicate significant differences in grain yield between treatments ($p < 0.05$), based on post-hoc tests.

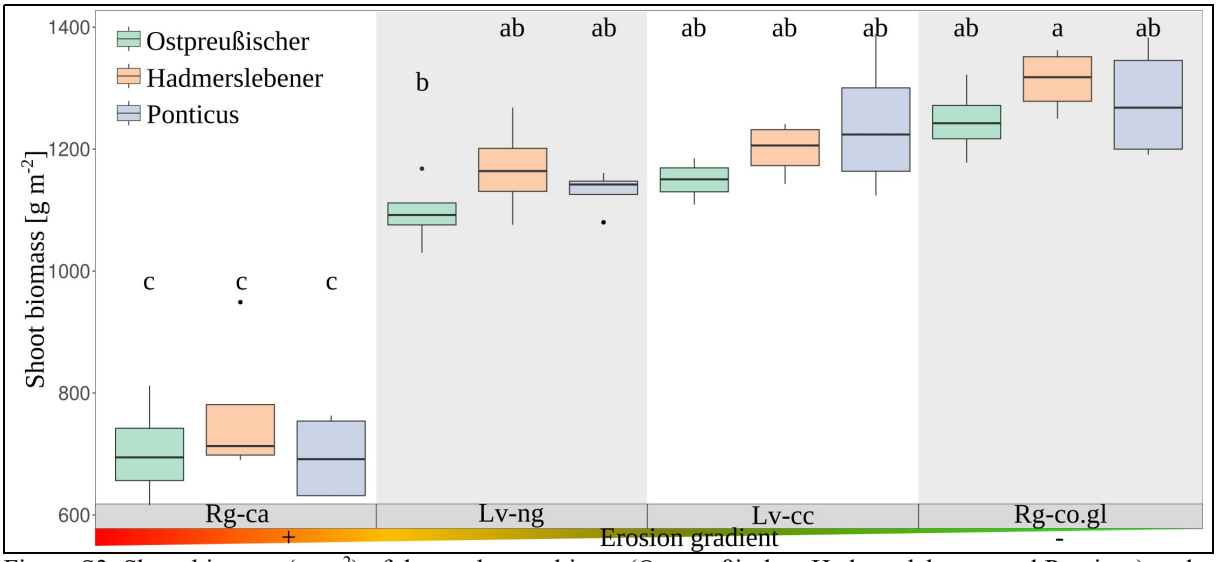

Figure S3. Shoot biomass (g m^{-2}) of three wheat cultivars (Ostpreußischer, Hadmerslebener, and Ponticus) under different soil erosional status: Calacric Regosol (RG-ca), Nudiargic Luvisol (LV-ng), Calcic Luvisol (LV-cc) and Gleyic-Colluvic Regosol (RG-co.gl). The letters above the boxplots indicate significant differences in grain yield between treatments ($p < 0.05$), based on post-hoc tests.

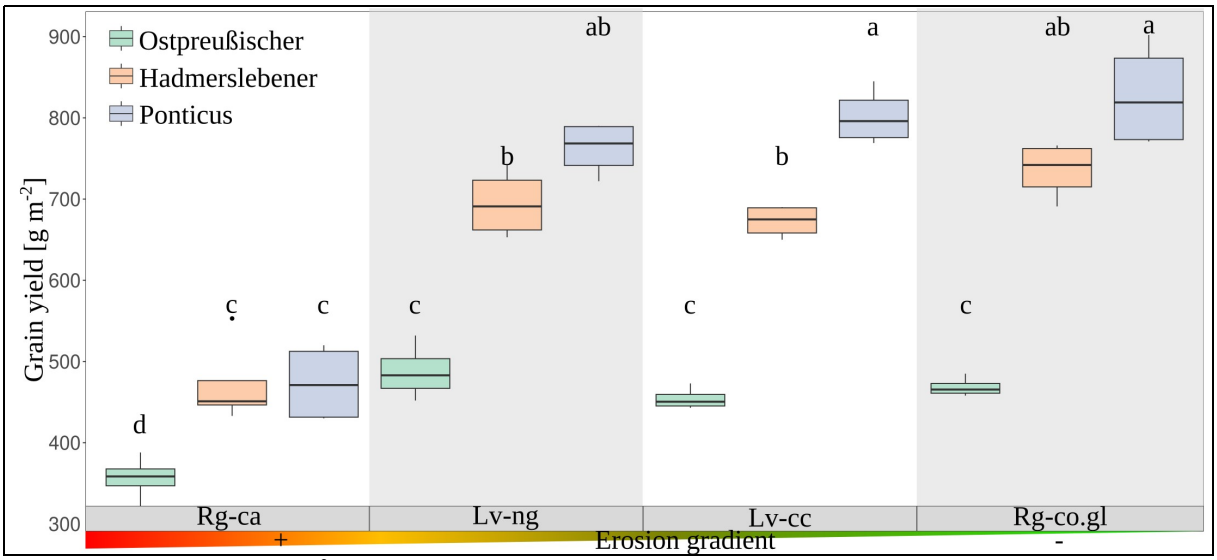

Figure S4. Grain yield (g m^{-2}) of three wheat cultivars (Ostpreußischer, Hadmerslebener, and Ponticus) under different soil erosional status: Calacric Regosol (RG-ca), Nudiargic Luvisol (LV-ng), Calcic Luvisol (LV-cc) and Gleyic-Colluvic Regosol (RG-co.gl). The letters above the boxplots indicate significant differences in grain yield between treatments ($p < 0.05$), based on post-hoc tests.

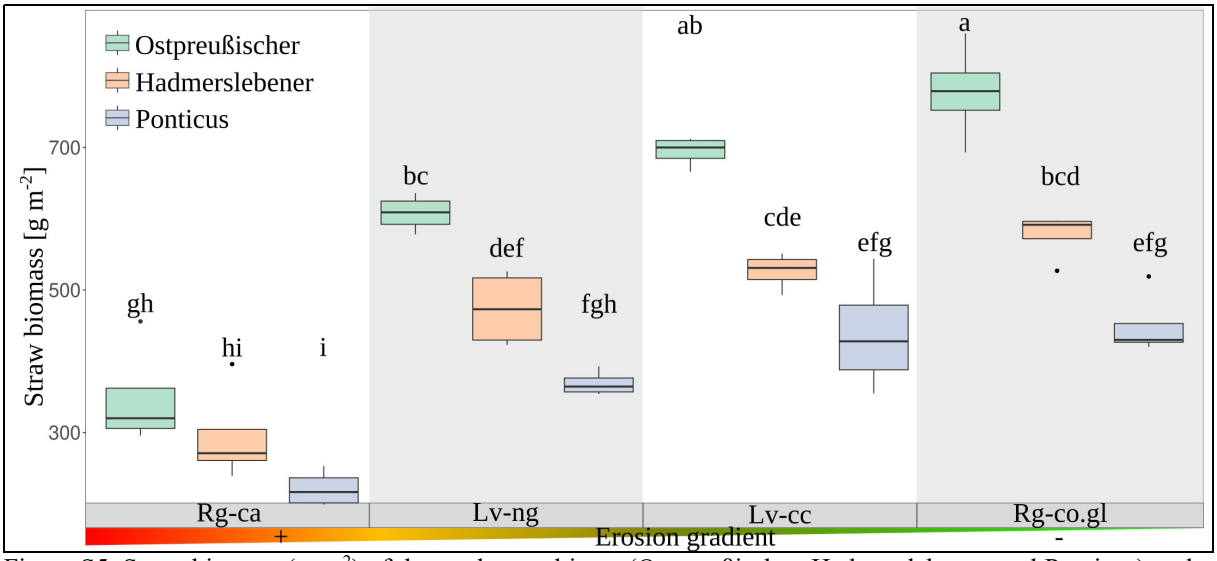

Figure S5. Straw biomass (g m^{-2}) of three wheat cultivars (Ostpreußischer, Hadmerslebener, and Ponticus) under different soil erosional status: Calacric Regosol (RG-ca), Nudiargic Luvisol (LV-ng), Calcic Luvisol (LV-cc) and Gleyic-Colluvic Regosol (RG-co.gl). The letters above the boxplots indicate significant differences in grain yield between treatments ($p < 0.05$), based on post-hoc tests.