

SUPPLEMENTARY INFORMATION (SI)

Table SI1. Initial chemical proprieties and concentrations of total, DTPA-extractable and water-extractable elements (mg kg⁻¹ DW) in biochar (mean ± s.e.; n = 3).

Parameter		Initial values				
pH		8.0				
EC (Ms cm ⁻¹)		1.45				
External SA _{N2} (m ² g ⁻¹)		26.1				
Internal SA _{CO2} (m ² g ⁻¹)		190.8				
Element	IGV ⁽ⁱ⁾	Total	DTPA	% ⁽ⁱⁱ⁾	Water	% ⁽ⁱⁱ⁾
P	-	1669±64.3	71.3±3.42	(4.27)	9.25±0.18	(0.55)
K	-	9653±352	2,075±53.8	(21.5)	1,655±25.6	(17.2)
Ca	-	31827±1,045	-		275±4.45	(0.87)
Mg	-	3888±176	601±19.9	(15.5)	166±3.07	(4.27)
S	-	1952±93.1	592±17.3	(30.3)	585±11.5	(30.0)
Zn	500	444±16.8	52.8±1.94	(11.9)	0.50±0.04	(0.11)
Cu	230	45.2±2.98	1.68±0.08	(3.72)	0.16±0.01	(0.34)
Ni	100	135±9.22	2.95±0.04	(2.19)	0.75±0.02	(0.56)
Co	-	5.04±0.39	0.19±0.002	(3.82)	0.11±0.004	(2.24)
Cd	1.5	2.74±0.17	0.38±0.01	(14.0)	<0.0025	
Pb	140	51.1±2.92	6.60±0.27	(12.9)	<0.005	

⁽ⁱ⁾ IGV: Italian guideline values for agricultural amendments according to Italian Legislative Decree 75/2010.

⁽ⁱⁱ⁾ In brackets: percentage of the DTPA-extractable or water-extractable element relative to its total concentration.

Table SI2. Field trial: Element concentrations (mean $\pm$ s.e.; n = 3) at harvest in grains, cob and crop residues (stem+leaves) of drought-tolerant (D24) and drought-sensitive (P1921) maize hybrids grown in BC-treated (BC1%, 1% w/w) and untreated (Unt) soils. Pb contents of grains, cob and stem+leaves were below the detection limit ($<3 \mu\text{g kg}^{-1}$ DW). Different letters indicate significant differences between treatments within the same hybrid and plant organ (Newman-Keuls test, $P \leq 0.05$).

Element	Grains				Cobs				Stem + leaves			
	D24		P1921		D24		P1921		D24		P1921	
	Unt	BC1%	Unt	BC1%	Unt	BC1%	Unt	BC1%	Unt	BC1%	Unt	BC1%
P	3444 $\pm$ 344	2916 $\pm$ 264	3455 $\pm$ 34 ^a	2352 $\pm$ 324 ^b	562 $\pm$ 69	776 $\pm$ 312	442 $\pm$ 24	534 $\pm$ 25	771 $\pm$ 132	591 $\pm$ 141	873 $\pm$ 52 ^a	536 $\pm$ 36 ^b
K	3752 $\pm$ 213	3933 $\pm$ 149	3845 $\pm$ 68 ^a	3309 $\pm$ 142 ^b	6031 $\pm$ 795	6754 $\pm$ 1323	4364 $\pm$ 279 ^b	7231 $\pm$ 544 ^a	7167 $\pm$ 1017	6296 $\pm$ 366	7187 $\pm$ 222	7206 $\pm$ 461
Ca	78 $\pm$ 6	77 $\pm$ 3	81 $\pm$ 14	83 $\pm$ 11	217 $\pm$ 36	606 $\pm$ 231	204 $\pm$ 40	233 $\pm$ 47	4718 $\pm$ 539	4157 $\pm$ 410	4675 $\pm$ 396	5226 $\pm$ 299
Mg	1401 $\pm$ 112	1422 $\pm$ 158	1469 $\pm$ 34 ^a	1107 $\pm$ 82 ^b	392 $\pm$ 28	644 $\pm$ 215	344 $\pm$ 29	351 $\pm$ 41	2690 $\pm$ 277	2180 $\pm$ 155	2682 $\pm$ 236	2683 $\pm$ 84
S	940 $\pm$ 25 ^a	806 $\pm$ 15 ^b	849 $\pm$ 25 ^a	720 $\pm$ 34 ^b	452 $\pm$ 78	578 $\pm$ 186	368 $\pm$ 14 ^a	482 $\pm$ 17 ^b	641 $\pm$ 64	543 $\pm$ 50	747 $\pm$ 41	633 $\pm$ 30
Zn	27 $\pm$ 2.42	28.7 $\pm$ 1.65	30.2 $\pm$ 1.45 ^a	23.5 $\pm$ 0.81 ^b	22.5 $\pm$ 2.88	25.9 $\pm$ 4.02	42.5 $\pm$ 7.29	29.8 $\pm$ 3.22	29.4 $\pm$ 2.03	27.8 $\pm$ 1.14	28.5 $\pm$ 2.55	31.9 $\pm$ 1.83
Cu	1.6 $\pm$ 0.16	1.95 $\pm$ 0.16	1.37 $\pm$ 0.07	1.36 $\pm$ 0.04	3.58 $\pm$ 0.63	3.74 $\pm$ 0.57	3.81 $\pm$ 0.12 ^b	4.25 $\pm$ 0.1 ^a	6.53 $\pm$ 0.65	4.75 $\pm$ 0.35	6.33 $\pm$ 0.41	5.96 $\pm$ 0.4
Ni	0.33 $\pm$ 0.001	0.48 $\pm$ 0.10	0.33 $\pm$ 0.02	0.29 $\pm$ 0.02	0.65 $\pm$ 0.31	0.36 $\pm$ 0.05	0.31 $\pm$ 0.04	0.35 $\pm$ 0.05	0.47 $\pm$ 0.05	0.4 $\pm$ 0.01	0.53 $\pm$ 0.09	0.52 $\pm$ 0.05
Co	0.03 $\pm$ 0.01	0.03 $\pm$ 0.001	0.02 $\pm$ 0.001	0.03 $\pm$ 0.001	0.04 $\pm$ 0.01	0.04 $\pm$ 0.01	0.03 $\pm$ 0.01	0.05 $\pm$ 0.02	0.09 $\pm$ 0.02	0.07 $\pm$ 0.001	0.11 $\pm$ 0.03	0.11 $\pm$ 0.02
Cd	0.07 $\pm$ 0.001	0.07 $\pm$ 0.01	0.06 $\pm$ 0.001	0.06 $\pm$ 0.001	0.08 $\pm$ 0.001	0.08 $\pm$ 0.01	0.08 $\pm$ 0.001	0.07 $\pm$ 0.001	0.14 $\pm$ 0.001	0.12 $\pm$ 0.01	0.13 $\pm$ 0.01	0.13 $\pm$ 0.01
Pb	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	0.09 $\pm$ 0.001	BDL	0.07 $\pm$ 0.001	0.07 $\pm$ 0.001

BDL: below detection limit.

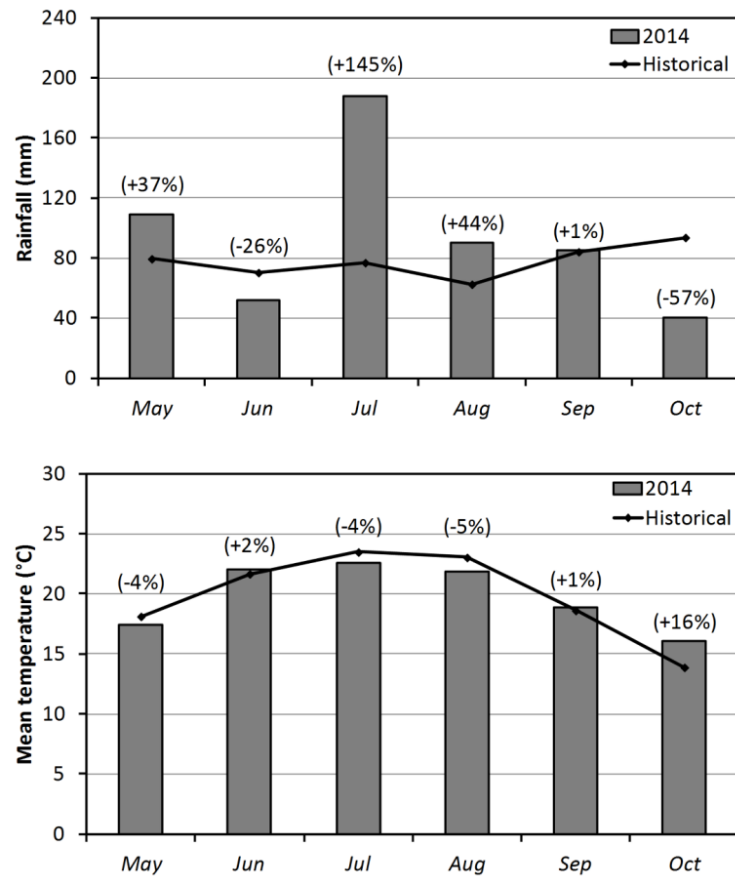


Figure SI1. Monthly rainfall and mean temperature during the field trial compared with historical means from 1992 to 2013. In brackets: percentage variation relative to the historical mean.

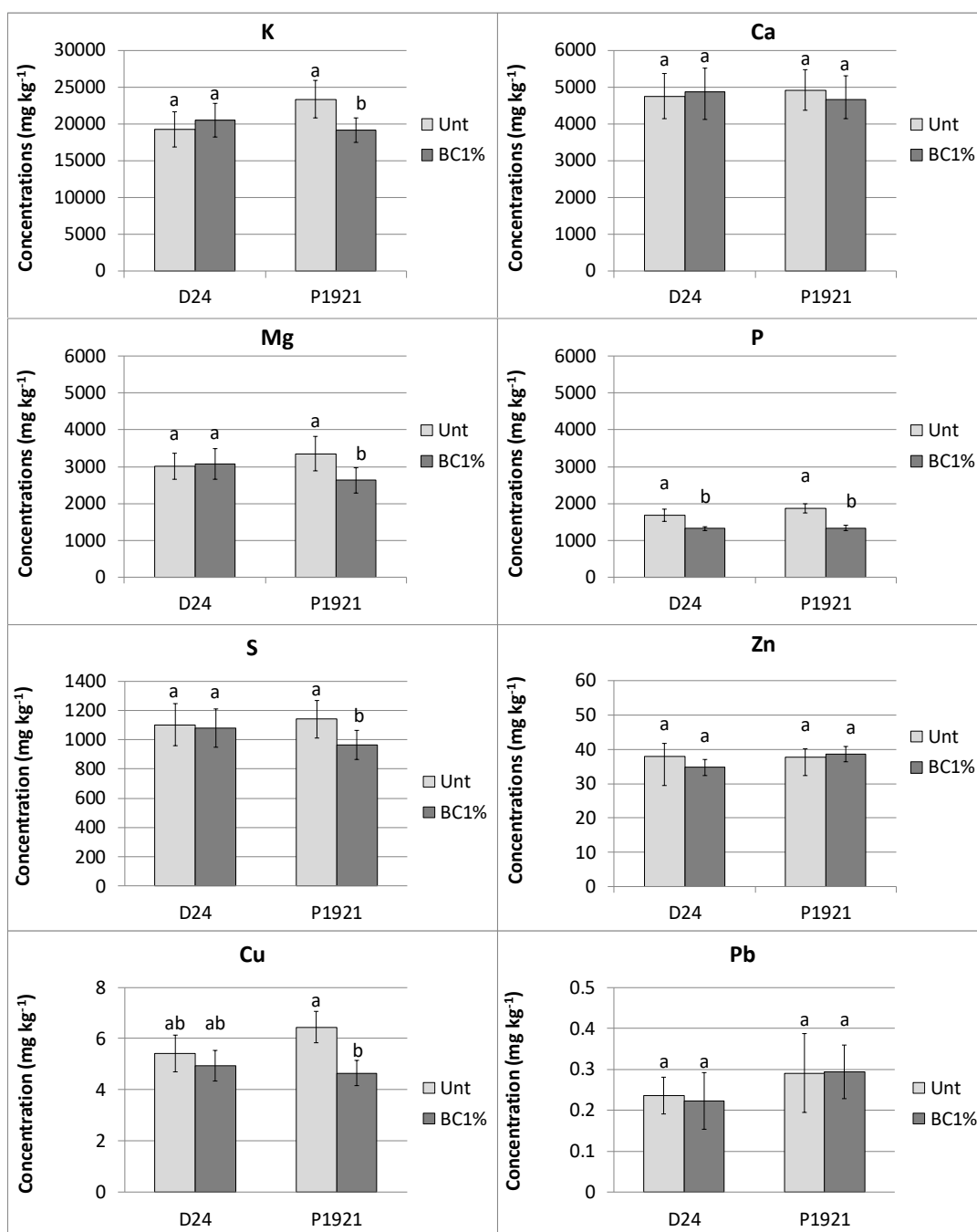


Figure S12. Pot trial: Element concentrations (mean in DW $\pm$ S.E.; n = 3) in shoots of drought-tolerant (D24) and drought-sensitive (P1921) maize hybrids grown in biochar-treated (BC1%, 1% w/w) and untreated soils (Unt) after progressive water stress. Different letters indicate significant differences between treatments within the same hybrid and element (Newman-Keuls test, $P \leq 0.05$).

Note the different scales for these elements.