

Supplementary information

Table S1. Nutrient concentrations of maize in a pot experiment at BBCH 32 and 85 in 2016–2021 as affected by type of P-fertilizer (TSP (triple superphosphate), BC (bone char), BC^{plus} (sulfur enriched bone char)). Low letters indicate significant differences (standard deviation in brackets, $p < 0.05$, Kruskal-Wallis test or Tukey test in dependence of normal distribution of data).

year	BBCH maize	harvest	fertilizer type	K (g kg ⁻¹)	Ca (g kg ⁻¹)	Mg (g kg ⁻¹)	N (g kg ⁻¹)	C (g kg ⁻¹)	S (g kg ⁻¹)
2016	32	whole plant	TSP	45.40 (3.20)	7.32 (0.34)	3.24 (0.02)	41.67 (2.55)	402.63 (4.85)	3.33 (0.52)
			BC	45.65 (2.79)	8.62 (0.35)	2.54 (0.31)	27.52 (4.04)	410.30 (5.26)	2.52 (0.20)
			BC ^{plus}	50.16 (1.18)	8.79 (0.46)	2.72 (0.30)	42.91 (4.27)	403.45 (3.82)	3.18 (0.37)
	85	straw	TSP	15.87 (0.09)	3.56 (0.38)	1.10 (0.12)	3.74 (0.75)	426.00 (1.84)	1.26 (0.19)
			BC	20.48 (2.11)	3.04 (1.18)	1.51 (0.42)	13.14 (1.33)	419.35 (2.66)	1.60 (0.06)
		grain	BC ^{plus}	17.11 (1.06)	3.32 (1.15)	0.88 (0.10)	4.55 (1.31)	430.75 (2.34)	1.31 (0.11)
			TSP	4.53 (0.11)	0.06 (0.01)	1.11 (0.04)	9.11 (1.12)	423.38 (5.13)	1.14 (0.19)
			BC	5.04 (0.41)	0.08 (0.01)	1.19 (0.16)	17.23 (3.51)	424.48 (2.21)	1.62 (0.20)
			BC ^{plus}	4.29 (0.22)	0.06 (0.01)	1.06 (0.06)	9.64 (0.24)	428.23 (2.23)	1.18 (0.07)
			TSP	4.53 (0.11)	0.06 (0.01)	1.11 (0.04)	9.11 (1.12)	423.38 (5.13)	1.14 (0.19)
2017	32	whole plant	TSP	45.58 (2.36)	5.70 (0.52)	3.85 (0.52)	28.64 (1.89)	420.55 (5.70)	2.35 (0.19)
			BC	57.92 (1.05)	5.35 (0.47)	2.86 (0.30)	29.21 (0.96)	414.40 (1.85)	2.06 (0.08)
			BC ^{plus}	46.20 (2.50)	5.68 (0.40)	3.48 (0.44)	29.56 (1.65)	421.63 (3.11)	2.62 (0.14)
	85	straw	TSP	13.73 (0.97)	4.36 (0.72)	1.81 (0.21)	5.84 (0.81)	440.15 (4.11)	1.71 (0.13)
			BC	13.95 (2.39)	2.79 (0.90)	1.74 (0.46)	7.97 (0.60)	436.33 (2.02)	1.50 (0.14)
		grain	BC ^{plus}	13.16 (0.66)	3.98 (0.61)	1.42 (0.20)	5.42 (0.31)	442.15 (3.86)	1.71 (0.13)
			TSP	4.54 (0.35)	*	1.00 (0.04)	8.38 (0.24)	435.40 (1.25)	1.38 (0.09)
			BC	4.54 (0.18)	*	1.00 (0.11)	13.65 (2.39)	435.33 (3.09)	1.50 (0.14)
			BC ^{plus}	4.51 (0.39)	*	0.93 (0.06)	8.15 (0.30)	434.38 (1.89)	1.32 (0.11)
			TSP	4.54 (0.35)	*	1.00 (0.04)	8.38 (0.24)	435.40 (1.25)	1.38 (0.09)

* below the detection limit

year	BBCH maize	harvest	fertilizer type	K (g kg ⁻¹)	Ca (g kg ⁻¹)	Mg (g kg ⁻¹)	N (g kg ⁻¹)	C (g kg ⁻¹)	S (g kg ⁻¹)
2018	32	whole plant	TSP	41.29 (7.29)	7.60 (0.56)	4.31 (0.67)	33.48 (1.36)	428.35 (21.84)	2.48 (0.05)
			BC	61.46 (0.82)	6.38 (1.60)	2.61 (0.37)	34.98 (1.78)	410.90 (4.51)	2.40 (0.14)
			BC ^{plus}	46.59 (5.22)	7.46 (0.65)	3.40 (0.04)	34.14 (1.15)	414.80 (2.28)	2.57 (0.04)
	85	straw	TSP	21.31 (1.60)	6.29 (0.70)	2.14 (0.26)	10.85 (0.97)	432.03 (2.22)	1.75 (0.42)
			BC	29.54 (6.14)	6.74 (1.72)	1.94 (0.28)	15.19 (4.19)	419.83 (12.53)	1.65 (0.36)
			BC ^{plus}	20.38 (1.59)	6.45 (0.54)	1.73 (0.06)	10.38 (1.64)	431.58 (2.77)	2.17 (0.13)
		grain	TSP	3.89 (0.31)	0.12 (0.01)	0.97 (0.04)	14.96 (0.37)	440.00 (1.37)	1.50 (0.15)
			BC	3.46 (0.16)	0.12 (0.02)	0.89 (0.08)	16.35 (2.33)	439.10 (2.27)	1.52 (0.18)
			BC ^{plus}	4.19 (0.06)	0.11 (0.01)	1.04 (0.03)	15.04 (0.42)	439.50 (1.09)	1.58 (0.21)
2019	32	whole plant	TSP	35.27 (3.16)	6.11 (0.49)	4.45 (0.45)	28.31 (1.58)	417.05 (2.27)	2.25 (0.64)
			BC	52.08 (3.70)	6.69 (1.96)	2.16 (0.21)	32.18 (3.65)	407.13 (4.04)	2.14 (0.18)
			BC ^{plus}	37.72 (3.92)	6.37 (0.45)	4.34 (0.34)	27.72 (1.43)	412.55 (3.01)	1.96 (0.14)
	85	straw	TSP	11.55 (0.68)	4.08 (0.21)	2.19 (0.17)	8.37 (1.65)	448.53 (2.44)	1.79 (0.60)
			BC	22.89 (5.02)	6.54 (2.12)	1.78 (0.32)	13.61 (3.90)	433.78 (10.55)	1.56 (0.39)
			BC ^{plus}	11.05 (1.01)	3.92 (0.16)	2.01 (0.07)	8.79 (1.00)	444.33 (1.66)	1.61 (0.13)
		grain	TSP	3.86 (0.14)	0.16 (0.01)	1.09 (0.09)	16.74 (1.38)	438.98 (1.38)	1.43 (0.04)
			BC	5.40 (1.19)	0.19 (0.02)	1.14 (0.20)	21.34 (2.41)	441.00 (0.76)	1.44 (0.01)
			BC ^{plus}	4.21 (0.18)	0.17 (0.01)	1.31 (0.13)	17.84 (2.80)	438.98 (0.77)	1.55 (0.09)

year	BBCH maize	harvest	fertilizer type	K (g kg ⁻¹)	Ca (g kg ⁻¹)	Mg (g kg ⁻¹)	N (g kg ⁻¹)	C (g kg ⁻¹)	S (g kg ⁻¹)	
2020	32	whole plant	TSP	45.91 (12.34)	6.21 (0.25)	5.06 (0.41)	30.86 (2.28)	407.10 (13.63)	2.27 (0.78)	a
			BC	44.56 (7.54)	8.66 (1.87)	3.25 (0.04)	31.61 (1.74)	404.75 (2.90)	1.64 (0.20)	b
			BC ^{plus}	41.77 (6.77)	5.89 (0.73)	4.72 (0.52)	30.02 (3.27)	410.63 (4.39)	1.85 (0.03)	ab
	85	straw	TSP	14.56 (3.04)	4.02 (1.07)	2.70 (0.57)	5.67 (1.71)	430.00 (4.34)	1.23 (0.62)	a
			BC	25.36 (2.51)	7.57 (1.91)	2.23 (0.09)	18.50 (5.71)	407.93 (8.60)	1.29 (0.56)	a
			BC ^{plus}	12.25 (1.20)	4.10 (0.14)	2.68 (0.21)	5.57 (1.38)	429.88 (3.90)	1.21 (0.51)	a
		grain	TSP	3.18 (0.26)	0.13(0)	0.96 (0.16)	15.59 (1.27)	438.20 (2.49)	1.26 (0.11)	a
			BC	5.54 (2.41)	0.17 (0.06)	1.16 (0.24)	20.61 (6.26)	430.33 (7.25)	1.37 (0.27)	a
			BC ^{plus}	3.79 (0.37)	0.13 (0.01)	1.21 (0.11)	16.06 (0.23)	439.00 (0.83)	1.41 (0.09)	a
2021	32	whole plant	TSP	22.33 (1.75)	5.49 (0.25)	4.22 (0.19)	15.46 (1.67)	417.15 (2.33)	1.44 (0.12)	a
			BC	40.04 (3.34)	9.03 (0.67)	2.76 (0.30)	32.10 (4.37)	405.30 (4.30)	1.68 (0.27)	a
			BC ^{plus}	27.72 (5.98)	5.26 (0.55)	4.02 (0.38)	17.13 (4.13)	414.15 (1.72)	1.59 (0.11)	a
	85	straw	TSP	13.21 (1.73)	5.41 (0.27)	3.85 (0.21)	7.22 (0.61)	434.98 (1.20)	1.85 (0.51)	b
			BC	25.70 (2.74)	8.52 (1.23)	2.94 (0.15)	26.09 (6.55)	403.40 (7.72)	1.82 (0.23)	b
			BC ^{plus}	11.90 (2.25)	5.28 (0.13)	3.58 (0.25)	7.33 (0.79)	435.88 (1.24)	2.64 (0.16)	a
		grain	TSP	2.90 (0.07)	0.10(0)	0.85 (0.04)	13.93 (0.97)	432.30 (1.35)	1.68 (0.18)	a
			BC	4.71 (0.73)	0.15 (0.03)	1.05 (0.07)	25.43 (4.22)	434.03 (5.21)	2.04 (0.44)	a
			BC ^{plus}	3.16 (0.13)	0.11 (0.01)	0.83 (0.06)	13.90 (1.21)	431.48 (1.02)	1.80 (0.24)	a