

Appendix 17. Element concentrations (dry weight basis) in shoots and roots of 24 *Austroanthonia* accessions (see Table 6.1) grown hydroponically with seven levels of Al (Chapter 6)

Data are means of replicated samples (mostly three replicates); values in parentheses are \pm standard errors (se); means without se are from bulked samples; - indicates insufficient samples for chemical analysis; concentrations of P, K, Na, Ca, Mg and S are in % and Mn, Fe, Cu, Zn, B and Mo in mg/kg

Elements	Shoot														Root					
	Al treatment (μ M)																			
	0	50	100	150	200	250	300	0	50	100	150	200	250	300						
Accessions (Ac) 1																				
P	0.30 (0.01)	0.31 (0.01)	0.27 (0.01)	0.34 (0.00)	0.33 (0.02)	0.32 (0.01)	0.28 (0.02)	0.39	0.44	0.38	0.40	0.45	0.49	0.40						
K	2.70 (0.06)	2.40 (0.07)	2.23 (0.12)	2.70 (0.04)	2.46 (0.16)	2.47 (0.12)	2.26 (0.18)	3.80	5.40	4.20	5.30	5.50	5.80	5.50						
Na	0.02 (0.00)	0.02 (0.00)	0.03 (0.00)	0.04 (0.00)	0.05 (0.00)	0.06 (0.01)	0.05 (0.01)	0.03	0.03	0.04	0.04	0.02	0.03	0.04						
Ca	0.32 (0.01)	0.54 (0.05)	0.41 (0.01)	0.53 (0.02)	0.51 (0.00)	0.49 (0.04)	0.48 (0.04)	0.23	0.30	0.27	0.28	0.23	0.24	0.24						
Mg	0.11 (0)	0.18 (0.01)	0.12 (0.00)	0.15 (0.00)	0.16 (0.00)	0.16 (0.02)	0.15 (0.01)	0.39	0.24	0.23	0.19	0.18	0.16	0.12						
S	0.24 (0.01)	0.24 (0.01)	0.23 (0.01)	0.27 (0)	0.25 (0.01)	0.23 (0.01)	0.22 (0.01)	0.32	0.34	0.27	0.35	0.35	0.38	0.43						
Mn	42.91 (4.49)	34.99 (1.43)	29.20 (0.38)	35.87 (2.50)	34.03 (3.05)	35.13 (1.23)	25.44 (1.08)	40.20	50.70	82.10	88.30	65.10	65.00	67.40						
Fe	57.01 (2.29)	72.45 (4.61)	71.78 (7.35)	81.34 (3.37)	78.37 (7.43)	78.12 (1.05)	65.71 (1.19)	182.90	110.40	142.60	210.00	220.00	157.70	180.30						
Cu	8.29 (0.82)	8.83 (0.51)	6.65 (0.48)	7.58 (0.26)	9.28 (1.22)	7.86 (0.52)	5.74 (0.29)	53.00	50.00	52.29	42.00	55.22	49.88	45.00						
Zn	39.82 (1.50)	45.52 (2.36)	35.81 (1.21)	38.33 (1.30)	39.79 (1.16)	43.68 (3.56)	39.43 (2.15)	91.90	101.00	105.00	106.00	85.80	96.00	98.80						
B	4.79 (0.09)	7.20 (0.56)	6.22 (0.10)	6.01 (0.24)	6.02 (0.09)	5.96 (0.34)	6.05 (0.28)	6.09	9.36	9.75	6.85	7.00	9.80	10.10						
Mo	7.22 (0.35)	7.32 (0.82)	7.12 (0.79)	11.11 (0.81)	11.74 (2.03)	9.18 (0.52)	5.66 (1.20)	11.23	12.21	10.65	25.08	28.35	19.74	15.16						
Ac 2																				
P	0.40	0.26	0.29	0.44	0.26	0.43	0.47	0.48	-	-	0.51	-	0.63	0.66						
K	2.70	1.82	2.00	2.60	1.76	2.80	2.90	4.90	-	-	5.50	-	5.90	6.00						
Na	0.05	0.09	0.08	0.04	0.09	0.03	0.04	0.07	-	-	0.09	-	0.09	0.08						
Ca	0.66	0.61	0.65	0.48	0.71	0.35	0.39	0.24	-	-	0.17	-	0.28	0.22						
Mg	0.20	0.19	0.22	0.15	0.22	0.16	0.15	0.38	-	-	0.12	-	0.11	0.11						
S	0.34	0.24	0.26	0.33	0.25	0.28	0.31	0.33	-	-	0.34	-	0.39	0.39						
Mn	53.39	35.79	31.95	36.85	36.73	43.84	34.18	32.00	-	-	32.50	-	53.50	52.60						
Fe	75.59	88.53	91.56	69.98	70.00	60.73	73.27	210.00	-	-	230.00	-	112.30	129.70						
Cu	5.39	5.94	6.09	8.53	6.02	7.44	8.51	14.00	-	-	17.03	-	11.57	10.67						
Zn	50.21	53.48	39.81	34.17	43.81	32.33	30.00	130.00	-	-	106.00	-	102.00	104.00						
B	6.30	5.93	6.56	4.66	7.85	5.11	4.41	3.65	-	-	4.81	-	3.35	4.68						
Mo	7.74	9.27	4.04	7.91	5.19	8.87	8.94	12.89	-	-	8.69	-	11.80	10.13						
Ac 3																				
P	0.27 (0.01)	0.30 (0.01)	0.22 (0.01)	0.30 (0.01)	0.32 (0.01)	0.31 (0.02)	0.34 (0.01)	0.29	0.35	0.47	0.37	0.43	0.39	0.37						
K	2.20 (0.04)	2.23 (0.15)	1.62 (0.06)	2.27 (0.11)	2.31 (0.08)	2.34 (0.10)	2.37 (0.06)	3.50	4.00	5.30	4.10	5.10	5.00	4.20						
Na	0.02 (0.00)	0.05 (0.01)	0.07 (0.01)	0.04 (0.01)	0.04 (0.00)	0.04 (0.00)	0.03 (0.00)	0.05	0.07	0.06	0.05	0.06	0.05	0.06						
Ca	0.28 (0.01)	0.43 (0.04)	0.63 (0.03)	0.39 (0.05)	0.54 (0.02)	0.40 (0.01)	0.28 (0.02)	0.26	0.18	0.21	0.16	0.26	0.30	0.36						
Mg	0.11 (0)	0.15 (0.01)	0.20 (0.01)	0.13 (0.01)	0.16 (0.01)	0.12 (0)	0.09 (0.01)	0.14	0.19	0.45	0.13	0.28	0.19	0.13						
S	0.29 (0.01)	0.29 (0.01)	0.19 (0.01)	0.24 (0.01)	0.28 (0.01)	0.26 (0)	0.26 (0.01)	0.27	0.29	0.55	0.30	0.46	0.43	0.35						
Mn	39.60 (1.96)	36.81 (1.42)	27.28 (1.64)	25.51 (3.13)	34.13 (0.87)	30.82 (1.97)	20.23 (2.03)	71.00	75.00	59.00	76.20	55.20	61.00	66.40						
Fe	48.29 (1.49)	81.68 (7.38)	67.65 (1.88)	57.10 (4.07)	86.89 (5.03)	68.55 (1.45)	71.11 (2.01)	120.60	200.00	135.50	121.40	169.20	142.50	230.00						
Cu	10.54 (0.26)	8.15 (0.22)	5.44 (0.59)	6.97 (0.50)	9.07 (0.39)	8.44 (0.50)	8.20 (0.36)	35.11	55.13	53.00	20.39	68.83	32.48	24.59						
Zn	40.41 (1.33)	65.89 (5.82)	28.60 (0.53)	30.87 (1.50)	36.08 (1.58)	33.84 (0.90)	31.21 (1.62)	154.40	115.00	194.40	141.00	155.70	230.00	330.00						
B	3.81 (0.14)	6.06 (0.69)	6.18 (0.31)	4.52 (0.19)	6.29 (0.08)	4.21 (0.07)	4.69 (0.25)	3.53	3.68	4.00	3.22	7.00	3.00	5.00						
Mo	4.29 (0.17)	6.79 (0.41)	3.38 (0.50)	4.77 (0.58)	7.30 (0.44)	6.71 (0.73)	5.59 (0.75)	7.40	8.44	10.25	6.35	17.00	13.66	10.11						

Elements	Shoot									Root					
	Al treatment (µM)														
	0	50	100	150	200	250	300	0	50	100	150	200	250	300	
Ac 4															
P	0.35 (0.01)	0.33 (0.02)	0.36 (0.01)	0.34 (0.01)	0.33 (0.01)	0.33 (0.01)	0.35 (0.01)	0.35 (0.01)	0.26	0.34	0.32	0.28	0.33	0.42	0.38
K	1.56 (0.07)	1.82 (0.07)	2.13 (0.09)	2.10 (0.04)	2.22 (0.11)	1.89 (0.04)	1.89 (0.04)	1.60	4.60	4.40	3.60	4.30	5.30	4.60	4.60
Na	0.04 (0)	0.09 (0.02)	0.06 (0.01)	0.05 (0)	0.07 (0)	0.06 (0.01)	0.06 (0)	0.02	0.01	0.03	0.03	0.04	0.04	0.03	0.03
Ca	0.60 (0.06)	0.59 (0.05)	0.60 (0.06)	0.47 (0.03)	0.68 (0.04)	0.49 (0.04)	0.66 (0.03)	0.18	0.18	0.14	0.17	0.20	0.13	0.21	0.21
Mg	0.20 (0.02)	0.19 (0.02)	0.20 (0.02)	0.19 (0.01)	0.22 (0.01)	0.17 (0.01)	0.21 (0.01)	0.34	0.28	0.20	0.19	0.16	0.22	0.14	0.14
S	0.28 (0.01)	0.25 (0.01)	0.29 (0)	0.25 (0.01)	0.28 (0.01)	0.26 (0)	0.30 (0)	0.33	0.29	0.25	0.22	0.28	0.31	0.29	0.29
Mn	39.06 (2.53)	31.70 (3.30)	35.45 (1.13)	23.78 (1.90)	36.30 (1.02)	34.92 (1.31)	29.11 (2.42)	55.00	50.00	45.20	89.70	49.90	47.40	43.20	43.20
Fe	98.28 (13.61)	78.80 (7.31)	114.01 (16.01)	65.31 (4.60)	107.69 (4.95)	68.89 (3.19)	109.59 (5.39)	210.00	108.40	110.00	136.00	130.90	140.70	400.00	400.00
Cu	9.64 (0.43)	8.92 (1.06)	9.85 (0.40)	7.29 (0.31)	9.15 (0.53)	8.56 (0.37)	8.92 (0.16)	60.00	62.00	55.64	53.31	64.00	51.78	22.86	22.86
Zn	54.59 (3.80)	50.99 (5.05)	89.55 (13.32)	38.87 (0.92)	43.73 (0.54)	43.94 (0.85)	50.87 (1.77)	93.40	108.00	104.00	110.30	170.70	150.00	130.40	130.40
B	6.68 (0.71)	6.10 (0.51)	8.34 (0.63)	5.84 (0.28)	7.49 (0.48)	5.89 (0.26)	7.64 (0.45)	10.00	10.00	5.79	10.00	10.00	9.00	10.00	10.00
Mo	7.39 (0.40)	7.63 (1.72)	8.52 (0.48)	5.33 (0.54)	6.58 (0.14)	7.13 (0.66)	8.23 (0.48)	16.82	17.06	9.89	9.90	9.01	10.77	14.82	14.82
Ac 5															
P	0.37 (0.01)	0.35 (0.01)	0.36 (0.01)	0.39 (0.01)	0.42 (0.01)	0.35 (0.01)	0.39 (0.01)	0.29	0.34	0.38	0.41	0.40	0.37	0.49	0.49
K	2.10 (0.02)	2.13 (0.05)	2.37 (0.01)	2.43 (0.03)	2.37 (0.05)	2.41 (0.05)	2.10 (0.02)	2.20	2.60	3.10	3.20	2.80	2.50	3.00	3.00
Na	0.03 (0)	0.03 (0)	0.02 (0)	0.03 (0)	0.04 (0)	0.04 (0)	0.03 (0.01)	0.02	0.04	0.03	0.03	0.03	0.02	0.02	0.02
Ca	0.34 (0.02)	0.36 (0.03)	0.27 (0.01)	0.31 (0.02)	0.46 (0.04)	0.36 (0.02)	0.26 (0.02)	0.20	0.21	0.16	0.12	0.17	0.13	0.12	0.12
Mg	0.15 (0.01)	0.14 (0.01)	0.12 (0)	0.13 (0)	0.17 (0.01)	0.14 (0.01)	0.11 (0.01)	0.12	0.14	0.11	0.10	0.10	0.10	0.11	0.11
S	0.25 (0.01)	0.28 (0.01)	0.27 (0)	0.29 (0)	0.31 (0.01)	0.27 (0.01)	0.27 (0)	0.30	0.35	0.38	0.36	0.36	0.35	0.37	0.37
Mn	53.27 (2.86)	39.88 (1.89)	40.08 (1.38)	39.99 (1.11)	42.60 (1.73)	34.98 (1.41)	32.86 (2.48)	280.00	210.00	260.00	220.00	193.60	126.00	161.40	161.40
Fe	73.19 (11.68)	53.71 (3.15)	57.90 (0.80)	72.22 (4.15)	91.40 (6.97)	75.21 (4.33)	79.79 (7.25)	240.00	220.00	171.70	260.00	180.20	180.20	400.00	400.00
Cu	7.34 (0.46)	6.62 (0.15)	7.22 (0.18)	6.62 (0.17)	7.50 (0.06)	6.26 (0.14)	6.80 (0.13)	9.87	14.68	13.14	10.66	14.02	11.07	10.57	10.57
Zn	36.63 (2.91)	35.39 (2.42)	43.00 (5.22)	33.24 (0.62)	35.17 (0.66)	31.87 (0.62)	27.59 (1.11)	72.10	77.10	82.40	42.00	80.60	44.30	57.70	57.70
B	7.51 (0.14)	6.89 (0.60)	7.57 (0.37)	8.26 (0.15)	9.19 (0.18)	7.69 (0.07)	9.05 (0.75)	8.00	9.00	6.18	7.94	9.30	6.00	7.00	7.00
Mo	8.36 (0.41)	9.31 (0.55)	12.64 (1.04)	10.70 (0.12)	12.36 (0.45)	10.04 (0.53)	10.85 (0.37)	9.80	8.99	11.56	9.50	11.03	9.79	13.53	13.53
Ac 6															
P	0.28	0.32	0.38	0.35	0.36	0.39	0.39	0.22	0.30	0.34	0.30	0.34	0.17	0.40	0.40
K	1.92	2.00	2.40	2.40	2.00	2.10	2.30	2.10	3.30	3.30	3.10	3.30	1.88	4.40	4.40
Na	0.03	0.05	0.03	0.04	0.06	0.04	0.04	0.05	0.04	0.03	0.04	0.03	0.01	0.05	0.05
Ca	0.33	0.44	0.35	0.31	0.40	0.37	0.38	0.26	0.21	0.14	0.24	0.18	0.10	0.21	0.21
Mg	0.13	0.16	0.15	0.13	0.17	0.16	0.16	0.31	0.41	0.37	0.32	0.50	0.12	0.34	0.34
S	0.26	0.27	0.34	0.30	0.30	0.32	0.33	0.27	0.27	0.32	0.32	0.34	0.14	0.40	0.40
Mn	54.83	41.99	71.36	45.62	49.36	59.07	46.23	220.00	156.30	151.90	147.30	210.00	147.00	166.60	166.60
Fe	47.08	75.15	63.09	69.29	75.81	82.46	73.82	192.00	158.50	139.90	169.50	193.20	162.20	350.00	350.00
Cu	6.30	7.01	8.90	7.95	7.76	9.15	7.96	16.36	24.64	25.66	17.72	17.11	16.50	17.04	17.04
Zn	42.47	52.66	47.44	40.93	46.60	50.04	41.70	200.00	137.00	177.00	210.00	113.30	182.30	144.30	144.30
B	4.82	5.53	5.33	4.79	5.73	5.09	5.04	10.00	10.00	7.00	9.00	10.00	7.00	9.73	9.73
Mo	5.00	6.54	6.47	6.11	6.26	7.93	7.18	11.84	8.21	7.53	6.73	10.00	8.00	10.44	10.44
Ac 7															
P	0.42 (0.03)	0.34 (0.03)	0.42 (0.04)	0.42 (0.03)	0.50 (0.03)	0.36 (0.01)	0.41 (0.03)	0.42	0.64	0.63	0.66	0.54	0.49	0.65	0.65
K	2.21 (0.11)	1.88 (0.02)	2.09 (0.10)	2.40 (0.08)	2.70 (0.10)	2.27 (0.03)	2.30 (0.16)	3.70	4.50	5.00	5.30	4.80	3.80	5.20	5.20
Na	0.02 (0)	0.04 (0)	0.05 (0.01)	0.04 (0)	0.01 (0)	0.03 (0)	0.04 (0.01)	0.04	0.04	0.05	0.04	0.02	0.02	0.03	0.03
Ca	0.38 (0.02)	0.38 (0.01)	0.44 (0.02)	0.42 (0.02)	0.39 (0.03)	0.34 (0)	0.40 (0.02)	0.34	0.33	0.38	0.33	0.20	0.16	0.24	0.24
Mg	0.16 (0.01)	0.16 (0)	0.19 (0.03)	0.16 (0.01)	0.17 (0.01)	0.14 (0)	0.16 (0.01)	0.57	0.87	0.59	0.66	0.47	0.29	0.32	0.32
S	0.34 (0.03)	0.26 (0.02)	0.33 (0.03)	0.30 (0.02)	0.41 (0.01)	0.32 (0)	0.33 (0.02)	0.36	0.38	0.43	0.39	0.46	0.36	0.46	0.46

Elements	Shoot												Root															
													Al treatment (μM)															
	0		50		100		150		200		250		300		0	50	100	150	200	250	300							
Mn	47.82	(6.65)	25.77	(2.71)	44.76	(8.60)	34.18	(4.17)	49.21	(3.76)	32.31	(1.09)	36.13	(3.77)	109.0	101.10	100.10	97.00	95.00	89.00	88.80							
Fe	57.36	(4.17)	59.47	(5.72)	78.24	(7.05)	72.30	(3.54)	76.06	(4.60)	66.35	(3.50)	92.03	(1.00)	188.3	240.00	161.70	270.00	155.50	146.40	320.00							
Cu	12.06	(0.49)	7.32	(1.07)	11.93	(2.19)	9.75	(1.13)	10.73	(0.25)	9.69	(0.17)	12.33	(1.51)	73.77	62.53	65.00	64.58	55.00	50.00	58.39							
Zn	42.99	(1.27)	38.31	(2.00)	50.50	(4.52)	43.29	(1.32)	44.48	(2.79)	39.57	(1.37)	46.12	(3.94)	350.0	300.00	320.00	310.00	156.90	86.40	166.50							
B	3.98	(0.01)	4.42	(0.16)	4.57	(0.13)	4.72	(0.05)	4.19	(0.06)	4.02	(0.08)	5.37	(0.25)	3.00	10.00	7.00	9.00	2.98	6.39	6.00							
Mo	6.51	(0.96)	4.81	(0.97)	9.75	(2.93)	7.45	(1.13)	16.34	(1.00)	9.12	(0.57)	9.68	(1.22)	14.96	15.13	22.27	15.14	19.91	17.76	18.46							
<u>Ac 8</u>																												
P	0.26	(0.02)	0.39	(0.02)	0.31	(0.03)	0.41	(0.01)	0.39	(0)	0.34	(0.02)	0.35	(0.03)	0.32	(0)	0.39	(0.01)	0.37	(0.01)	0.43	(0)	0.52	(0.01)	0.59	(0.03)	0.42	(0.02)
K	2.08	(0.12)	2.70	(0.17)	2.54	(0.19)	2.70	(0.08)	2.34	(0.08)	2.17	(0.10)	1.88	(0.06)	3.50	(0.07)	4.80	(0.17)	4.20	(0.08)	4.80	(0.06)	4.73	(0.05)	5.45	(0.28)	4.10	(0.30)
Na	0.02	(0)	0.01	(0)	0.02	(0)	0.01	(0)	0.02	(0)	0.03	(0)	0.02	(0)	0.03	(0)	0.04	(0)	0.04	(0)	0.04	(0)	0.03	(0)	0.08	(0)	0.04	(0)
Ca	0.41	(0.03)	0.25	(0.01)	0.37	(0.04)	0.31	(0.01)	0.32	(0.02)	0.38	(0.01)	0.34	(0.02)	0.19	(0.01)	0.31	(0.01)	0.14	(0)	0.38	(0.04)	0.15	(0.01)	0.35	(0.05)	0.36	(0.08)
Mg	0.12	(0.01)	0.08	(0)	0.11	(0.01)	0.08	(0)	0.10	(0.01)	0.12	(0)	0.10	(0.01)	0.15	(0)	0.15	(0)	0.12	(0)	0.13	(0.01)	0.12	(0)	0.12	(0)	0.12	(0.01)
S	0.26	(0.01)	0.34	(0)	0.29	(0.01)	0.33	(0)	0.31	(0)	0.29	(0.01)	0.28	(0.01)	0.30	(0.01)	0.36	(0.03)	0.30	(0.01)	0.36	(0.01)	0.38	(0.01)	0.36	(0.01)	0.36	(0.03)
Mn	46.45	(1.44)	55.65	(1.70)	38.61	(1.49)	50.75	(4.37)	38.51	(1.88)	31.79	(2.64)	31.95	(1.91)	97.80	(2.41)	91.30	(2.82)	104.40	(4.75)	88.50	(8.47)	92.20	(5.34)	78.90	(2.28)	56.00	(3.93)
Fe	50.20	(1.07)	57.96	(1.57)	56.46	(0.23)	58.10	(0.38)	61.80	(3.19)	70.61	(1.19)	57.81	(1.61)	105.7	(7.45)	106.30	(9.04)	108.10	(6.39)	139.90	(4.99)	152.10	(11.85)	121.00	(0.93)	276.20	(54.37)
Cu	7.18	(0.77)	85.75	(0.21)	8.29	(0.98)	8.35	(0.19)	9.32	(0.41)	7.89	(0.42)	6.48	(0.52)	59.29	(12.92)	36.52	(5.63)	40.72	(2.22)	22.98	(0.24)	38.26	(8.84)	49.39	(13.13)	31.40	(0.76)
Zn	38.13	(1.31)	45.74	(0.92)	38.31	(1.55)	40.10	(1.97)	36.05	(1.21)	39.31	(1.09)	36.71	(1.94)	105.9	(7.86)	273.30	(12.02)	148.50	(0.27)	288.90	(27.66)	154.60	(7.80)	299.00	(7.94)	182.90	(48.05)
B	3.97	(0.09)	4.57	(0.09)	4.73	(0.03)	4.79	(0.11)	4.34	(0.10)	5.17	(0.14)	4.46	(0.29)	7.00	(0.38)	4.82	(0.49)	4.00	(0)	4.57	(0.59)	6.33	(0.25)	9.50	(0.19)	6.50	(0.19)
Mo	3.51	(0.53)	12.06	(0.47)	5.78	(0.85)	11.58	(0.81)	7.81	(0.55)	5.46	(0.66)	6.08	(1.04)	10.55	(1.26)	18.95	(3.03)	9.97	(0.51)	17.87	(1.47)	16.55	(0.73)	14.76	(0.72)	18.55	(2.30)
<u>Ac 9</u>																												
P	0.32	(0.01)	0.34	(0.01)	0.32	(0.02)	0.36	(0.01)	0.36	(0.01)	0.41	(0.02)	0.42	(0.02)	0.36		0.34		0.41		0.40		0.44		0.45		0.65	
K	2.36	(0.12)	2.27	(0.05)	2.01	(0.12)	2.63	(0.13)	2.33	(0.07)	2.60	(0.10)	2.57	(0.08)	4.00		3.80		4.40		4.30		4.20		4.50		5.10	
Na	0.02	(0.00)	0.03	(0.00)	0.02	(0)	0.02	(0)	0.03	(0)	0.02	(0)	0.03	(0)	0.05		0.07		0.04		0.06		0.06		0.06		0.06	
Ca	0.38	(0.04)	0.36	(0.02)	0.31	(0.01)	0.33	(0.01)	0.45	(0.05)	0.27	(0.01)	0.38	(0.02)	0.26		0.44		0.16		0.26		0.26		0.36		0.17	
Mg	0.13	(0.01)	0.13	(0.01)	0.12	(0.01)	0.12	(0)	0.14	(0.01)	0.10	(0.01)	0.13	(0.01)	0.19		0.17		0.17		0.14		0.12		0.12		0.12	
S	0.26	(0.01)	0.27	(0.01)	0.25	(0.01)	0.31	(0)	0.31	(0.01)	0.31	(0.01)	0.29	(0.01)	0.29		0.31		0.32		0.30		0.34		0.36		0.37	
Mn	42.42	(2.59)	34.50	(2.17)	35.70	(2.95)	36.21	(2.23)	37.51	(2.37)	30.38	(0.14)	30.59	(3.21)	115.0		114.10		100.30		131.30		102.00		95.60		98.90	
Fe	61.01	(2.41)	64.74	(1.71)	52.80	(1.15)	62.06	(2.57)	73.15	(7.00)	55.41	(0.80)	71.15	(4.47)	137.2		125.60		114.20		195.70		143.80		124.90		440.00	
Cu	9.20	(0.80)	8.66	(0.53)	8.03	(0.94)	8.99	(0.28)	9.64	(0.17)	8.72	(0.39)	9.50	(0.56)	37.60		47.08		48.38		39.94		51.00		31.71		21.56	
Zn	51.26	(5.06)	40.44	(0.37)	35.64	(1.08)	37.34	(1.21)	37.96	(1.88)	37.24	(0.43)	35.27	(1.95)	200.0		260.00		167.60		187.70		182.90		170.00		114.50	
B	5.58	(0.09)	4.97	(0.14)	4.16	(0.15)	4.86	(0.16)	5.77	(0.42)	4.97	(0.12)	6.47	(0.23)	2.30		4.00		3.27		3.00		3.00		5.00		5.00	
Mo	5.40	(0.83)	5.91	(1.05)	6.56	(1.79)	7.66	(0.57)	8.76	(0.37)	8.09	(0.99)	9.51	(0.99)	9.54		14.76		16.73		14.03		15.76		15.03		24.43	
<u>Ac 10</u>																												
P	0.30	(0.01)	0.25	(0.03)	0.33	(0.03)	0.41	(0.04)	0.38	(0.02)	0.61	(0.04)	0.34	(0.02)	0.51		0.41		0.78		0.70		0.50		0.80		0.65	
K	1.75	(0.03)	1.32	(0.21)	2.02	(0.17)	2.39	(0.16)	2.50	(0.08)	2.16	(0.05)	1.93	(0.11)	4.10		3.90		4.90		4.60		4.00		3.90		4.70	
Na	0.04	(0)	0.09	(0.02)	0.06	(0.01)	0.03	(0)	0.02	(0)	0.02	(0)	0.05	(0.01)	0.07		0.03		0.02		0.03		0.04		0.03		0.02	
Ca	0.45	(0.02)	0.46	(0.04)	0.49	(0.04)	0.37	(0.05)	0.28	(0.01)	0.30	(0.02)	0.35	(0.01)	0.46		0.42		0.15		0.22		0.40		0.41		0.23	
Mg	0.16	(0)	0.14	(0.01)	0.17	(0.01)	0.14	(0.01)	0.11	(0)	0.12	(0)	0.14	(0)	0.41		0.64		0.66		0.73		0.53		0.53		0.38	
S	0.23	(0.02)	0.25	(0.01)	0.24	(0.01)	0.27	(0.02)	0.27	(0.01)	0.31	(0.01)	0.23	(0.01)	0.38		0.39		0.45		0.38		0.46		0.46		0.37	
Mn	35.22	(2.53)	59.16	(3.67)	48.17	(5.50)	72.99	(8.10)	59.30	(4.32)	82.36	(4.95)	34.62	(2.35)	48.00		68.30		92.30		84.00		71.50		56.60		45.00	

Fe	56.00 (4.21)	61.57 (0.75)	73.60 (5.07)	70.49 (6.19)	71.39 (5.44)	72.64 (3.43)	63.09 (2.22)	189.60	114.90	173.00	270.00	210.00	220.00	330.00	
Cu	6.33 (0.29)	10.02 (0.60)	7.80 (0.66)	10.50 (1.05)	621.80 (0.45)	10.74 (0.02)	6.83 (0.61)	45.30	52.00	27.68	34.19	34.66	34.42	20.39	
Zn	47.36 (2.00)	96.57 (12.70)	40.54 (1.62)	60.90 (5.54)	44.54 (2.14)	57.11 (3.39)	38.72 (1.23)	370.00	390.00	203.00	240.00	380.00	400.00	210.00	
B	5.17 (0.37)	7.19 (1.21)	5.32 (0.19)	4.01 (0.37)	3.72 (0.13)	5.74 (0.37)	5.26 (0.25)	6.00	6.00	5.00	2.00	3.00	2.14	5.00	
Mo	3.45 (0.45)	9.11 (0.98)	7.57 (1.57)	5.01 (0.43)	7.83 (0.15)	7.19 (0.32)	5.68 (1.31)	9.29	10.15	14.41	14.08	13.01	17.80	13.15	
Elements	Shoot							Root							
	Al treatment (µM)														
	0	50	100	150	200	250	300	0	50	100	150	200	250	300	
<u>Ac 11</u>															
P	0.29 (0.01)	0.36 (0.01)	0.36 (0.01)	0.33 (0.00)	0.31 (0.01)	0.31 (0)	0.23 (0.01)	0.43	0.53	0.49	0.46	0.46	0.54	0.46	
K	2.33 (0.01)	2.37 (0.03)	2.57 (0.06)	2.33 (0.03)	2.37 (0.03)	2.23 (0.01)	1.80 (0.01)	3.40	4.20	4.50	4.00	3.90	4.00	3.60	
Na	0.03 (0)	0.02 (0)	0.03 (0)	0.03 (0)	0.04 (0)	0.03 (0)	0.03 (0)	0.06	0.06	0.06	0.06	0.05	0.07	0.06	
Ca	0.49 (0.03)	0.37 (0.02)	0.36 (0.01)	0.40 (0.02)	0.41 (0.01)	0.35 (0.02)	0.28 (0.01)	0.53	0.22	0.29	0.24	0.21	0.29	0.25	
Mg	0.15 (0.01)	0.12 (0)	0.12 (0)	0.12 (0.01)	0.13 (0)	0.11 (0.01)	0.10 (0.01)	0.17	0.13	0.12	0.11	0.09	0.13	0.13	
S	0.26 (0)	0.29 (0.01)	0.28 (0)	0.28 (0)	0.28 (0)	0.27 (0)	0.21 (0)	0.25	0.26	0.24	0.22	0.23	0.26	0.25	
Mn	45.06 (2.79)	40.72 (0.27)	31.81 (0.65)	31.39 (0.97)	22.53 (0.12)	20.84 (0.77)	16.61 (0.54)	140.00	143.00	165.60	138.80	127.70	130.40	107.90	
Fe	50.42 (2.00)	55.07 (1.36)	53.85 (2.07)	55.30 (1.38)	59.23 (0.92)	49.53 (2.00)	47.24 (0.96)	210.00	136.70	138.80	173.60	300.00	143.30	260.00	
Cu	6.10 (0.11)	6.80 (0.21)	6.73 (0.15)	6.28 (0.14)	5.50 (0.07)	5.21 (0.08)	4.05 (0.09)	30.05	28.06	28.16	18.59	18.03	30.05	14.99	
Zn	33.41 (1.32)	30.33 (0.59)	24.92 (0.40)	29.05 (1.59)	22.94 (0.17)	25.68 (0.86)	24.05 (1.08)	190.00	120.70	157.50	108.70	104.50	168.80	184.00	
B	5.95 (0.33)	5.56 (0.27)	5.58 (0.06)	5.83 (0.17)	5.91 (0.28)	5.08 (0.09)	4.42 (0.20)	5.00	4.19	3.00	3.25	2.95	4.11	8.00	
Mo	2.54 (0.05)	4.51 (0.13)	4.39 (0)	3.85 (0.08)	3.24 (0.13)	2.82 (0.07)	1.67 (0.07)	9.47	7.30	7.35	5.03	6.11	5.35	6.58	
<u>Ac 12</u>															
P	0.44 (0.01)	0.48 (0)	0.44 (0.01)	0.48 (0.01)	0.48 (0.02)	0.45 (0.02)	0.51 (0)	0.48	(0)	0.57 (0.01)	0.49 (0)	0.63 (0.03)	0.57 (0.02)	0.56 (0.02)	0.71 (0.03)
K	2.57 (0.12)	2.80 (0.04)	2.63 (0.01)	3.00 (0.10)	2.43 (0.03)	2.37 (0.06)	2.33 (0.01)	3.50	(0.06)	4.17 (0.05)	4.37 (0.03)	4.73 (0.08)	4.47 (0.05)	4.03 (0.16)	5.03 (0.03)
Na	0.01 (0)	0.02 (0)	0.01 (0)	0.02 (0)	0.02 (0)	0.02 (0)	0.02 (0)	0.06	(0)	0.05 (0)	0.05 (0)	0.06 (0)	0.05 (0)	0.06 (0)	0.05 (0)
Ca	0.28 (0)	0.33 (0.02)	0.25 (0.01)	0.28 (0.01)	0.30 (0.01)	0.27 (0.01)	0.30 (0.01)	0.52	(0.07)	0.35 (0.07)	0.32 (0.05)	0.36 (0.01)	0.33 (0.05)	0.40 (0.06)	0.31 (0.03)
Mg	0.11 (0)	0.12 (0.01)	0.10 (0)	0.10 (0)	0.11 (0)	0.10 (0)	0.10 (0)	0.13	(0)	0.13 (0)	0.10 (0)	0.11 (0)	0.10 (0)	0.10 (0)	0.11 (0)
S	0.29 (0)	0.31 (0.01)	0.31 (0.01)	0.31 (0.01)	0.31 (0)	0.31 (0.01)	0.32 (0)	0.29	(0.01)	0.25 (0.01)	0.29 (0.01)	0.30 (0.02)	0.29 (0)	0.29 (0.01)	0.33 (0)
Mn	58.19 (2.26)	42.00 (1.99)	41.72 (1.59)	35.22 (1.60)	35.62 (2.02)	28.32 (1.28)	24.11 (0.81)	123.3	(3.33)	147.70 (11.92)	151.70 (7.12)	136.20 (15.83)	106.30 (7.07)	110.10 (9.81)	119.10 (4.22)
Fe	52.38 (1.77)	57.06 (0.92)	49.87 (1.14)	54.18 (0.76)	51.55 (0.56)	46.72 (0.25)	56.43 (1.64)	181.8	(3.49)	124.90 (4.09)	135.30 (11.64)	161.10 (11.51)	171.10 (9.39)	145.00 (5.34)	266.90 (35.43)
Cu	7.81 (0.15)	8.59 (0.17)	7.63 (0.11)	6.57 (0.15)	6.73 (0.26)	6.45 (0.21)	6.07 (0.06)	18.72	(1.94)	19.47 (1.52)	17.26 (0.25)	12.61 (0.32)	12.59 (0.23)	14.93 (1.01)	12.40 (0.31)
Zn	33.03 (0.76)	30.80 (0.42)	25.84 (0.22)	27.19 (1.29)	27.52 (1.02)	25.14 (0.41)	23.98 (1.14)	405.0	(49.74)	284.00 (5.13)	253.10 (58.03)	305.20 (21.18)	267.90 (62.90)	362.50 (66.97)	254.50 (37.72)
B	4.29 (0.27)	4.19 (0.10)	3.79 (0.27)	4.30 (0.10)	5.26 (0.19)	4.92 (0.34)	5.39 (0.27)	5.00	(0)	6.00 (0.38)	4.67 (0.33)	4.02 (0.22)	4.62 (0.29)	5.67 (0.83)	5.33 (0.33)
Mo	3.95 (0.16)	6.76 (0.12)	7.05 (0.26)	6.63 (0.08)	7.63 (0.58)	5.53 (0.46)	6.27 (0.19)	8.75	(0.22)	8.23 (0.15)	7.28 (0.13)	7.16 (0.54)	7.53 (0.27)	7.53 (0.60)	8.77 (0.56)
<u>Ac 13</u>															
P	0.48 (0.01)	0.39 (0.01)	0.38 (0.02)	0.34 (0.01)	0.30 (0.01)	0.27 (0.01)	0.22 (0)	0.57	0.54	0.58	0.60	0.57	0.54	0.44	
K	2.37 (0.07)	2.23 (0.05)	2.33 (0.03)	2.43 (0.01)	2.30 (0.04)	2.11 (0.06)	2.17 (0.03)	3.10	4.20	4.90	4.40	4.90	4.50	4.00	
Na	0.03 (0.01)	0.03 (0)	0.04 (0.01)	0.03 (0.01)	0.03 (0.00)	0.02 (0)	0.07 (0.01)	0.05	0.05	0.04	0.07	0.06	0.05	0.05	
Ca	0.59 (0.05)	0.42 (0)	0.49 (0.03)	0.40 (0.01)	0.47 (0.02)	0.36 (0.02)	0.52 (0.05)	0.38	0.33	0.24	0.46	0.34	0.25	0.23	
Mg	0.18 (0.02)	0.13 (0)	0.16 (0.01)	0.12 (0.01)	0.15 (0.01)	0.11 (0.01)	0.18 (0.02)	0.16	0.10	0.08	0.08	0.09	0.12	0.09	
S	0.35 (0.01)	0.28 (0)	0.31 (0)	0.27 (0.01)	0.27 (0.01)	0.26 (0.01)	0.25 (0)	0.24	0.25	0.26	0.25	0.27	0.27	0.23	
Mn	52.81 (0.81)	29.34 (0.85)	29.12 (1.59)	23.46 (2.05)	22.75 (2.04)	17.29 (1.15)	20.30 (1.93)	169.0	139.70	107.30	156.30	150.00	119.90	101.00	

Elements	Shoot										Root						
	Al treatment (µM)																
	0	50	100	150	200	250	300	0	50	100	150	200	250	300			
Fe	65.94 (3.24)	53.82 (0.28)	61.36 (1.50)	52.94 (0.52)	63.23 (2.42)	51.45 (0.32)	67.89 (4.88)	151.5	0	158.70	124.20	199.30	163.90	137.10	195.40		
Cu	8.65 (0.29)	6.53 (0.16)	6.56 (0.20)	5.91 (0.28)	5.63 (0.28)	5.23 (0.21)	4.83 (0.24)	18.54	0	28.30	14.27	13.73	22.80	16.16	18.98		
Zn	38.24 (3.92)	27.40 (0.54)	28.76 (2.15)	23.62 (1.01)	24.33 (1.81)	21.49 (0.61)	27.68 (1.93)	310.0	0	210.00	140.20	390.00	230.00	138.20	190.00		
B	6.77 (0.37)	5.81 (0.05)	7.03 (0.17)	6.42 (0.38)	7.12 (0.16)	6.39 (0.38)	5.77 (0.07)	1.89	0	4.06	2.29	2.19	3.11	2.47	7.00		
Mo	3.50 (0.10)	3.69 (0.33)	4.15 (0.35)	3.20 (0.33)	3.21 (0.38)	2.72 (0.24)	1.31 (0.02)	5.66	0	7.22	6.92	5.11	6.40	5.56	4.00		
<u>Ac 14</u>																	
P	0.37	0.34 (0.01)	0.31 (0.01)	0.37 (0.01)	0.38 (0.01)	0.33 (0.01)	0.38 (0)	-	0	0.35	0.31	0.37	0.42	0.56	0.45		
K	2.40	2.20 (0)	1.79 (0.01)	2.06 (0.07)	2.24 (0.12)	2.20 (0.04)	1.93 (0.07)	-	0	4.00	2.70	4.20	3.90	5.00	3.90		
Na	0.02	0.02 (0)	0.03 (0.01)	0.03 (0)	0.06 (0)	0.05 (0.01)	0.04 (0)	-	0	0.05	0.02	0.05	0.05	0.05	0.02		
Ca	0.76	0.37 (0.03)	0.36 (0.05)	0.37 (0.02)	0.76 (0.08)	0.38 (0.02)	0.48 (0.03)	-	0	0.58	0.16	0.40	0.49	0.66	0.22		
Mg	0.19	0.15 (0.01)	0.15 (0.01)	0.16 (0.01)	0.23 (0.01)	0.18 (0.01)	0.20 (0.01)	-	0	0.25	0.19	0.23	0.18	0.24	0.17		
S	0.31	0.30 (0)	0.26 (0)	0.31 (0)	0.36 (0.01)	0.27 (0.01)	0.33 (0)	-	0	0.31	0.31	0.29	0.33	0.38	0.37		
<u>Ac 15</u>																	
P	0.33 (0.02)	0.34 (0.01)	0.35 (0.01)	0.34 (0.01)	0.37 (0)	0.40 (0.00)	0.39 (0)	0.31	-	-	0.33	0.42	0.34	0.37	0.53		
K	2.37 (0.08)	2.10 (0.04)	2.53 (0.07)	2.49 (0.12)	2.67 (0.03)	2.57 (0.03)	2.28 (0.06)	4.20	-	-	4.10	4.60	4.20	4.20	4.90		
Na	0.04 (0)	0.06 (0.01)	0.04 (0.01)	0.04 (0.01)	0.04 (0.01)	0.02 (0)	0.05 (0.01)	0.03	-	-	0.03	0.04	0.02	0.03	0.03		
Ca	0.46 (0.04)	0.61 (0.01)	0.44 (0.05)	0.36 (0.01)	0.50 (0.09)	0.27 (0.01)	0.43 (0.01)	0.23	-	-	0.17	0.27	0.14	0.23	0.16		
Mg	0.17 (0.01)	0.22 (0)	0.18 (0.01)	0.17 (0.01)	0.20 (0.02)	0.14 (0)	0.19 (0)	0.33	-	-	0.29	0.29	0.21	0.19	0.23		
S	0.25 (0.02)	0.24 (0.01)	0.32 (0.01)	0.28 (0.01)	0.35 (0.01)	0.34 (0.01)	0.33 (0.01)	0.38	-	-	0.40	0.43	0.40	0.41	0.58		
Mn	38.69 (3.42)	54.35 (4.59)	58.40 (5.94)	49.38 (1.52)	58.40 (4.05)	56.00 (1.69)	58.37 (5.61)	173.00	-	-	111.00	116.70	99.20	97.80	116.50		
Fe	69.44 (3.53)	85.32 (3.30)	72.49 (3.68)	74.38 (2.19)	86.73 (10.09)	61.75 (0.79)	77.75 (1.94)	164.60	-	-	107.60	177.50	130.30	140.80	300.00		
Cu	6.99 (0.41)	7.45 (0.15)	10.17 (0.46)	8.73 (0.13)	9.47 (0.19)	10.27 (0.16)	8.71 (0.29)	28.59	-	-	38.23	27.33	27.34	38.46	22.78		
Zn	42.22 (1.82)	50.79 (6.50)	38.36 (1.61)	47.39 (3.55)	38.52 (3.01)	36.78 (0.92)	58.15 (6.31)	250.00	-	-	102.00	250.00	188.00	197.10	97.70		
B	8.38 (0.56)	9.23 (0.45)	6.83 (0.42)	6.61 (0.11)	6.19 (0.26)	4.93 (0.22)	7.35 (0.30)	10.00	-	-	6.00	10.00	5.00	4.00	10.00		
Mo	5.46 (0.43)	3.65 (0.13)	9.56 (1.08)	7.34 (0.34)	9.83 (0.47)	10.85 (0.37)	7.95 (0.49)	10.00	-	-	12.07	11.51	10.70	11.59	17.79		
<u>Ac 16</u>																	
P	0.43 (0.01)	0.39 (0.01)	0.46 (0.02)	0.46 (0.01)	0.47 (0.03)	0.46 (0.03)	0.55 (0.03)	-	-	-	0.63	0.73	0.89	0.91	0.97		
K	2.13 (0.07)	2.05 (0.06)	1.90 (0.15)	2.23 (0.05)	1.93 (0.01)	2.09 (0.03)	2.11 (0.03)	-	-	-	3.30	3.70	4.30	4.00	4.40		
Na	0.06 (0.01)	0.04 (0.00)	0.05 (0)	0.05 (0.01)	0.04 (0.00)	0.05 (0)	0.03 (0.00)	-	-	-	0.07	0.04	0.04	0.05	0.08		
Ca	0.57 (0.06)	0.37 (0.01)	0.51 (0.04)	0.48 (0.04)	0.43 (0.04)	0.37 (0.02)	0.35 (0.03)	-	-	-	0.37	0.27	0.41	0.31	0.27		
Mg	0.20 (0.01)	0.15 (0)	0.18 (0)	0.18 (0.02)	0.17 (0.01)	0.16 (0)	0.14 (0.01)	-	-	-	0.28	0.29	0.23	0.20	0.29		
S	0.32 (0.01)	0.28 (0)	0.31 (0.01)	0.33 (0.01)	0.34 (0.01)	0.33 (0.01)	0.37 (0.01)	-	-	-	0.32	0.35	0.39	0.39	0.51		
Mn	61.33 (13.23)	39.82 (3.87)	39.85 (1.41)	49.87 (4.14)	47.53 (1.48)	31.30 (1.82)	32.19 (2.28)	-	-	-	50.80	74.20	32.80	25.70	48.00		
Fe	101.00 (0.38)	98.17 (9.44)	102.87 (3.43)	116.65 (7.98)	101.23 (5.57)	102.67 (1.35)	108.27 (7.86)	-	-	-	250.00	300.00	210.00	220.00	310.00		
Cu	9.60 (0.66)	7.70 (0.13)	11.18 (0.77)	10.68 (0.47)	8.12 (0.27)	7.97 (0.34)	9.00 (0.19)	-	-	-	15.00	9.77	14.27	10.27	11.81		
Zn	63.10 (4.58)	59.64 (7.32)	62.79 (6.46)	78.08 (8.88)	53.73 (3.64)	57.78 (4.71)	43.27 (2.31)	-	-	-	390.00	195.00	430.00	290.00	280.00		
B	7.38 (0.11)	5.46 (0.16)	7.91 (0.29)	7.59 (0.53)	6.29 (0.22)	6.34 (0.35)	8.27 (0.14)	-	-	-	10.00	6.00	6.00	10.00	10.00		
Mo	8.17 (1.23)	4.68 (0.36)	10.22 (0.80)	6.67 (0.70)	8.88 (1.30)	6.09 (0.10)	8.12 (0.76)	-	-	-	12.30	8.67	15.74	14.19	15.12		

Ac 17																												
	0.30	(0)	0.27	(0.01)	0.29	(0.01)	0.26	(0.01)	0.25	(0.01)	0.25	(0)	0.25	(0.02)	0.50	0.46	0.44	0.44	0.41	0.47	0.55							
P	2.22	(0.07)	2.50	(0.07)	2.40	(0.04)	2.37	(0.05)	2.33	(0.05)	1.99	(0.06)	2.09	(0.10)	3.00	3.30	3.60	3.50	3.30	3.60	4.00							
Na	0.03	(0)	0.02	(0)	0.03	(0)	0.02	(0)	0.02	(0)	0.02	(0)	0.03	(0)	0.09	0.06	0.05	0.08	0.07	0.06	0.05							
Ca	0.39	(0.02)	0.25	(0.01)	0.39	(0.01)	0.28	(0.01)	0.30	(0.03)	0.22	(0.01)	0.40	(0.01)	0.30	0.24	0.27	0.32	0.46	0.17	0.23							
Mg	0.15	(0)	0.10	(0)	0.14	(0)	0.10	(0)	0.11	(0.01)	0.10	(0)	0.14	(0)	0.15	0.13	0.11	0.14	0.19	0.13	0.12							
S	0.24	(0.01)	0.25	(0.01)	0.28	(0.00)	0.25	(0.01)	0.25	(0)	0.20	(0.01)	0.24	(0.01)	0.24	0.23	0.22	0.22	0.23	0.22	0.24							
Mn	33.08	(4.66)	30.42	(2.36)	34.66	(1.53)	25.50	(1.81)	25.21	(1.47)	20.97	(0.92)	22.10	(1.27)	120.00	161.70	173.00	188.00	155.50	151.00	164.30							
Fe	45.06	(1.43)	37.88	(1.65)	54.38	(0.91)	44.76	(1.70)	44.60	(1.27)	35.76	(0.94)	48.59	(2.47)	220.00	107.20	142.90	310.00	184.50	165.20	250.00							
Cu	6.19	(0.45)	5.08	(0.33)	6.26	(0.16)	4.92	(0.36)	5.41	(0.15)	4.90	(0.21)	4.80	(0.29)	39.95	24.23	21.90	18.23	26.94	25.84	11.98							
Zn	34.01	(2.19)	25.47	(0.72)	24.59	(0.65)	22.87	(1.27)	22.79	(0.94)	21.85	(0.28)	21.23	(0.84)	210.00	147.70	200.00	250.00	240.00	162.00	193.30							
B	5.67	(0.10)	5.05	(0.14)	5.74	(0.19)	4.85	(0.26)	4.84	(0.22)	4.27	(0.06)	5.20	(0.21)	6.00	5.00	3.79	3.00	5.00	7.00	5.00							
Mo	2.16	(0.17)	2.20	(0.29)	3.55	(0.23)	2.59	(0.25)	2.92	(0.13)	1.79	(0.17)	2.81	(0.42)	8.30	5.98	7.35	5.38	6.54	7.18	6.60							
Elements	Shoot										Root																	
	Al treatment (µM)																											
	0	50	100	150	200	250	300	0	50	100	150	200	250	300														
Ac 18																												
P	0.44	(0.01)	0.40	(0.04)	0.33	(0.02)	0.62	(0.02)	0.27	(0.01)	0.55	(0.01)	0.38	(0.05)	0.62	0.68	0.85	0.87	-	0.91	0.83							
K	2.53	(0.08)	2.36	(0.22)	2.13	(0.06)	3.03	(0.07)	1.95	(0.01)	2.68	(0.18)	2.36	(0.20)	4.60	5.30	6.30	9.50	-	6.70	6.40							
Na	0.02	(0)	0.04	(0)	0.08	(0.01)	0.01	(0)	0.09	(0)	0.02	(0)	0.07	(0.01)	0.09	0.06	0.05	0.10	-	0.03	0.07							
Ca	0.35	(0.02)	0.43	(0.02)	0.56	(0.02)	0.38	(0.03)	0.59	(0.01)	0.33	(0.01)	0.58	(0.07)	0.37	0.49	0.40	0.42	-	0.32	0.35							
Mg	0.12	(0)	0.15	(0.01)	0.20	(0.01)	0.13	(0.01)	0.21	(0)	0.12	(0)	0.19	(0.02)	0.47	0.56	0.82	0.44	-	0.49	0.42							
S	0.29	(0.01)	0.23	(0.02)	0.21	(0.01)	0.34	(0.01)	0.19	(0)	0.31	(0)	0.27	(0.03)	0.29	0.28	0.28	0.97	-	0.44	0.40							
Mn	67.84	(2.40)	42.49	(8.50)	32.52	(2.54)	90.67	(5.84)	24.84	(1.71)	75.18	(0.97)	48.79	(10.49)	51.00	55.50	46.90	56.60	-	53.20	32.20							
Fe	77.28	(1.26)	83.55	(2.91)	73.32	(0.90)	91.14	(0.39)	73.37	(1.00)	90.10	(1.78)	115.39	(5.96)	183.20	250.00	133.80	260.00	-	179.10	157.40							
Cu	15.21	(0.34)	10.00	(1.33)	9.33	(0.83)	10.20	(0.14)	7.22	(0.22)	10.02	(0.12)	11.27	(1.35)	50.06	28.50	45.24	55.09	-	57.91	29.39							
Zn	55.66	(2.05)	58.92	(2.12)	59.75	(2.35)	59.98	(2.94)	42.30	(2.58)	54.57	(2.19)	63.23	(5.05)	690.00	650.00	420.00	460.00	-	300.00	250.00							
B	5.97	(0.13)	7.10	(0.22)	5.99	(0.11)	7.33	(0.13)	5.81	(0.10)	7.45	(0.34)	7.37	(0.34)	5.00	5.00	6.00	6.53	-	5.00	8.00							
Mo	9.44	(0.07)	8.65	(1.83)	5.67	(1.02)	7.16	(0.57)	3.63	(0.23)	6.74	(0.46)	10.18	(2.34)	11.12	15.19	20.00	16.32	-	24.42	17.98							
Ac 19																												
P	0.23	(0.00)	0.45	(0.02)	0.37	(0.03)	0.23	(0.01)	0.32	(0.03)	0.33	(0.02)	0.32	(0.02)	-	0.60	0.50	0.62	0.53	0.43	0.52							
K	1.80	(0.05)	2.40	(0.17)	2.34	(0.12)	1.63	(0.08)	2.05	(0.10)	2.30	(0.16)	1.99	(0.06)	-	5.80	4.40	6.00	4.40	4.40	5.50							
Na	0.04	(0)	0.04	(0)	0.05	(0.01)	0.10	(0.01)	0.07	(0.01)	0.05	(0.01)	0.05	(0.01)	-	0.05	0.04	0.03	0.03	0.05	0.03							
Ca	0.72	(0.07)	0.53	(0.05)	0.52	(0.05)	0.73	(0.06)	0.64	(0.05)	0.53	(0.08)	0.46	(0.04)	-	0.45	0.35	0.26	0.14	0.23	0.21							
Mg	0.20	(0.01)	0.16	(0.01)	0.17	(0.02)	0.25	(0.02)	0.22	(0.02)	0.16	(0.02)	0.14	(0.02)	-	0.18	0.31	0.16	0.22	0.18	0.13							
S	0.21	(0.01)	0.35	(0.02)	0.38	(0.03)	0.24	(0)	0.29	(0.02)	0.32	(0.01)	0.32	(0)	-	0.28	0.52	0.36	0.46	0.43	0.44							
Mn	25.53	(0.49)	52.49	(1.36)	38.38	(2.02)	35.97	(2.62)	47.05	(3.85)	36.71	(4.54)	26.61	(2.11)	-	106.80	105.10	89.00	88.80	96.00	100.40							
Fe	80.92	(8.83)	88.57	(2.32)	76.86	(3.81)	80.72	(1.77)	89.50	(7.18)	88.75	(11.41)	73.58	(5.99)	-	156.00	129.30	163.10	151.70	134.50	340.00							
Cu	6.88	(0.29)	11.81	(0.31)	10.83	(0.94)	9.13	(0.20)	9.97	(0.62)	11.42	(0.29)	8.65	(0.70)	-	16.47	18.14	19.80	36.53	48.54	25.90							
Zn	46.08	(1.41)	39.99	(1.61)	39.22	(3.11)	39.22	(3.11)	79.32	(6.91)	54.60	(4.10)	61.78	(11.40)	-	370.00	300.00	210.00	264.00	265.00	244.00							
B	7.55	(0.30)	6.86	(0.61)	4.43	(0.15)	5.52	(0.10)	6.39	(0.41)	4.87	(0.47)	5.11	(0.37)	-	3.00	8.00	4.00	8.00	5.00	3.00							
Mo	4.03	(0.27)	5.12	(0.24)	4.97	(0.24)	4.33	(0.33)	7.01	(1.35)	7.78	(0.78)	8.58	(1.01)	-	10.29	16.65	8.46	15.79	9.94	12.47							
Ac 20																												
P	0.63	(0)	0.64	(0)	0.57	(0)	0.66	(0)	0.59	(0)	0.54	(0)	0.46	(0)	0.63	(0)	0.82	(0.02)	0.77	(0.03)	0.98	(0.04)	0.86	(0.01)	0.71	(0.01)	0.78	(0.03)
K	2.70	(0)	3.10	(0)	2.80	(0)	2.80	(0)	2.90	(0)	3.10	(0)	2.80	(0)	4.27	(0.13)	4.40	(0.27)	5.23	(0.09)	4.60	(0.34)	4.87	(0.34)	4.60	(0.25)	5.27	(0.17)
Na	0.01	(0)	0.02	(0)	0.02	(0)	0.02	(0)	0.02	(0)	0.02	(0)	0.03	(0)	0.05	(0)	0.05	(0)	0.04	(0)	0.03	(0)	0.03	(0)	0.04	(0)	0.06	(0.01)
Ca	0.50	(0)	0.46	(0)	0.47	(0)	0.45	(0)	0.47	(0)	0.43	(0)	0.57	(0)	0.29	(0.03)	0.30	(0.02)	0.21	(0.01)	0.28	(0.03)	0.17	(0.01)	0.29	(0.04)	0.22	(0.03)

Mg	0.15	0.14	0.13	0.12	0.13	0.13	0.17	0.19 (0.01)	0.15 (0.01)	0.12 (0)	0.11 (0)	0.11 (0)	0.11 (0)	0.11 (0)	0.11 (0)	0.10 (0)	0.10 (0)
S	0.37	0.36	0.34	0.39	0.36	0.35	0.33	0.29 (0)	0.30 (0)	0.31 (0.01)	0.33 (0.01)	0.35 (0)	0.32 (0)	0.32 (0)	0.32 (0.01)		
Mn	89.46	72.13	48.37	56.75	34.28	45.11	29.78	146.70 (5.04)	185.20 (20.69)	137.40 (4.72)	142.10 (13.25)	152.60 (10.79)	186.30 (7.07)	109.00 (1.95)			
Fe	63.20	63.61	65.90	69.45	63.36	62.11	80.92	187.90 (10.12)	117.40 (6.07)	100.20 (1.83)	180.90 (12.94)	140.20 (0.79)	132.00 (5.87)	267.80 (18.14)			
Cu	10.77	9.82	9.09	9.30	8.72	8.73	6.46	24.94 (2.27)	23.07 (1.15)	19.75 (0.87)	15.59 (0.44)	24.67 (2.53)	24.47 (0.83)	13.48 (0.17)			
Zn	47.26	33.14	30.75	32.35	27.72	29.40	34.13	275.00 (50.07)	259.10 (18.19)	184.40 (9.41)	261.30 (4.05)	175.40 (5.26)	243.70 (5.80)	261.30 (3.06)			
B	5.68	6.23	6.75	6.23	7.67	6.56	5.55	2.45 (0.12)	2.19 (0.07)	3.29 (0.34)	3.52 (0.31)	2.93 (0.21)	3.76 (0.62)	6.00 (0.22)			
Mo	4.49	7.21	8.37	9.99	7.89	6.88	5.12	10.19 (0.65)	9.76 (0.26)	8.66 (0.27)	11.06 (0.50)	10.19 (0.10)	8.37 (0.11)	8.91 (0.70)			
Ac 21																	
P	0.61 (0.03)	0.72 (0.03)	0.69 (0.02)	0.57 (0.03)	0.58 (0.02)	0.45 (0.04)	0.32 (0.02)	0.50 (0.02)	0.65 (0)	0.56 (0.02)	0.57 (0)	0.51 (0.02)	0.56 (0.04)	0.52 (0.02)			
K	2.83 (0.03)	3.07 (0.11)	2.93 (0.05)	2.67 (0.01)	2.57 (0.05)	2.03 (0.03)	2.12 (0.06)	3.63 (0.12)	4.50 (0.12)	4.47 (0.05)	4.47 (0.12)	3.67 (0.09)	3.20 (0)	4.00 (0.04)			
Na	0.01 (0)	0.01 (0)	0.02 (0)	0.02 (0)	0.02 (0)	0.03 (0)	0.03 (0)	0.05 (0)	0.02 (0)	0.02 (0)	0.04 (0)	0.01 (0)	0.02 (0)	0.03 (0)			
Ca	0.33 (0.01)	0.35 (0.01)	0.33 (0)	0.36 (0.01)	0.30 (0.01)	0.55 (0.07)	0.40 (0.01)	0.36 (0.01)	0.22 (0.02)	0.18 (0.01)	0.31 (0.02)	0.13 (0.01)	0.21 (0.02)	0.23 (0)			
Mg	0.12 (0)	0.13 (0)	0.13 (0)	0.12 (0)	0.10 (0)	0.17 (0.02)	0.13 (0.01)	0.26 (0.02)	0.32 (0.02)	0.22 (0)	0.22 (0.01)	0.18 (0.01)	0.16 (0)	0.15 (0.01)			
Elements																	
Shoot																	
Root																	
Al treatment (µM)																	
	0	50	100	150	200	250	300	0	50	100	150	200	250	300			
S	0.35 (0.01)	0.37 (0)	0.36 (0.00)	0.34 (0.01)	0.33 (0)	0.34 (0.01)	0.28 (0.01)	0.27 (0.01)	0.27 (0.01)	0.29 (0.01)	0.29 (0.01)	0.30 (0.01)	0.34 (0.02)	0.31 (0.00)			
Mn	62.36 (2.00)	56.23 (0)	36.37 (0.78)	34.26 (1.71)	27.13 (2.12)	32.28 (3.23)	18.40 (1.09)	100.50 (1.25)	82.80 (9.01)	97.10 (1.98)	88.70 (6.15)	99.80 (4.68)	92.90 (7.98)	94.30 (5.46)			
Fe	60.88 (1.94)	68.27 (1.64)	60.70 (0.83)	61.05 (1.15)	58.29 (0.94)	87.21 (10.99)	60.10 (2.46)	182.10 (14.14)	126.90 (6.61)	115.20 (6.99)	159.00 (2.41)	128.90 (6.09)	164.40 (11.11)	206.40 (88.17)			
Cu	8.84 (0.21)	9.39 (0.09)	9.28 (0.26)	7.40 (0.33)	7.87 (0.23)	7.10 (0.60)	4.33 (0.04)	25.96 (2.59)	19.98 (2.63)	24.05 (1.05)	12.90 (0.59)	16.30 (1.58)	11.67 (0.24)	11.54 (0.65)			
Zn	37.30 (0.54)	37.68 (0.72)	32.92 (1.72)	28.13 (0.66)	22.50 (0.78)	33.82 (4.50)	25.08 (1.75)	183.30 (18.56)	163.50 (14.92)	134.00 (8.43)	278.00 (21.80)	140.00 (7.91)	160.90 (14.79)	189.90 (2.36)			
B	5.37 (0.01)	6.39 (0.12)	6.28 (0.19)	6.87 (0.36)	6.23 (0.22)	8.24 (0.64)	6.43 (0.04)	3.50 (0.36)	4.70 (0.63)	6.58 (0.80)	5.81 (0.84)	4.87 (0.43)	6.00 (1.13)	6.00 (0)			
Mo	3.62 (0.10)	5.46 (0.08)	3.86 (0.16)	3.57 (0.29)	3.33 (0.09)	2.65 (0.17)	1.76 (0.07)	6.12 (0.32)	6.04 (0.17)	5.75 (0.05)	5.55 (0.12)	5.83 (0.35)	6.88 (0.71)	6.53 (0.55)			
Ac 22																	
P	0.35	0.44	0.32	0.50	0.39	0.45	0.39	0.45	0.45	-	0.51	0.39	0.37	0.37			
K	2.40	2.40	2.10	2.30	2.30	2.30	2.40	4.20	4.50	-	4.40	4.30	3.90	4.30			
Na	0.01	0.01	0.01	0.02	0.02	0.01	0.02	0.02	0.05	-	0.05	0.04	0.04	0.02			
Ca	0.53	0.40	0.49	0.57	0.40	0.35	0.37	0.13	0.31	-	0.38	0.19	0.16	0.18			
Mg	0.19	0.15	0.19	0.19	0.12	0.11	0.12	0.31	0.35	-	0.22	0.16	0.17	0.16			
S	0.29	0.44	0.21	0.37	0.41	0.42	0.39	0.43	0.40	-	0.39	0.47	0.42	0.43			
Mn	34.80	56.11	30.24	37.82	46.38	37.14	25.07	0.01	0.01	-	0.00	64.00	0.01	0.01			
Fe	75.18	79.28	59.48	67.42	67.52	67.18	76.73	193.10	155.20	-	180.80	150.00	132.10	340.00			
Cu	8.79	7.70	6.24	10.26	10.40	10.29	10.48	36.03	29.74	-	26.78	30.28	44.93	22.86			
Zn	63.35	47.24	45.38	49.39	39.51	43.93	36.56	195.50	220.00	-	270.00	149.50	101.60	129.30			
B	6.42	4.59	5.54	5.83	6.12	5.10	4.58	4.00	2.00	-	5.00	2.13	2.00	5.00			
Mo	5.36	5.91	10.71	13.72	13.52	13.88	9.95	20.00	16.35	-	30.38	18.73	15.27	16.68			
Ac 23																	
P	0.46 (0.02)	0.46 (0.02)	0.54 (0.01)	0.39 (0.03)	0.55 (0)	0.53 (0.01)	0.41 (0.03)	0.39 (0.01)	0.42 (0.01)	0.47 (0.02)	0.50 (0.01)	0.57 (0.01)	0.61 (0.01)	0.64 (0.02)			
K	2.80 (0.08)	2.90 (0.11)	2.90 (0.06)	2.37 (0.07)	2.77 (0.08)	2.87 (0.05)	2.34 (0.16)	4.10 (0)	4.63 (0.05)	5.43 (0.09)	4.25 (0.28)	5.47 (0.07)	5.40 (0.04)	5.45 (0.02)			
Na	0.02 (0)	0.01 (0)	0.01 (0)	0.02 (0)	0.02 (0)	0.01 (0)	0.02 (0)	0.06 (0.01)	0.05 (0)	0.05 (0)	0.06 (0.01)	0.04 (0)	0.04 (0)	0.05 (0)			
Ca	0.42 (0.03)	0.37 (0.03)	0.27 (0)	0.49 (0.05)	0.35 (0.01)	0.30 (0.01)	0.42 (0.03)	0.33 (0.08)	0.31 (0.04)	0.18 (0.01)	0.38 (0.07)	0.12 (0.01)	0.20 (0.01)	0.28 (0.01)			
Mg	0.16 (0.01)	0.12 (0.01)	0.08 (0)	0.17 (0.02)	0.11 (0.01)	0.09 (0.01)	0.13 (0.01)	0.25 (0.01)	0.16 (0.01)	0.16 (0)	0.16 (0.01)	0.14 (0.01)	0.13 (0)	0.11 (0.01)			
S	0.31 (0.02)	0.32 (0.01)	0.36 (0.01)	0.28 (0.01)	0.36 (0)	0.33 (0.01)	0.31 (0.02)	0.30 (0.01)	0.31 (0.01)	0.36 (0.01)	0.31 (0.01)	0.35 (0.01)	0.39 (0.01)	0.39 (0.01)			
Mn	45.82 (3.04)	44.81 (3.08)	53.45 (3.27)	55.42 (4.77)	37.87 (1.14)	42.79 (2.72)	29.08 (2.20)	113.50 (2.46)	103.70 (2.68)	108.20 (0.82)	125.60 (4.46)	96.70 (2.20)	95.00 (0.98)	108.90 (4.12)			
Fe	66.91 (3.30)	65.67 (1.63)	65.10 (1.14)	76.61 (2.58)	73.15 (2.65)	66.23 (0.35)	89.15 (5.73)	150.10 (11.76)	112.80 (4.20)	95.90 (0.76)	220.90 (41.25)	137.70 (9.94)	124.30 (3.27)	372.00 (97.53)			
Cu	10.72 (0.66)	11.47 (0.90)	13.88 (0.43)	10.21 (1.17)	12.85 (0.27)	12.78 (0.33)	10.18 (0.04)	38.90 (0.41)	42.82 (5.85)	56.83 (1.93)	29.40 (1.60)	33.79 (2.25)	43.94 (7.80)	19.59 (2.58)			
Zn	75.20 (6.90)	50.87 (1.14)	43.84 (1.85)	56.62 (4.59)	50.13 (3.36)	40.92 (0.28)	41.18 (1.09)	271.00 (7.18)	231.70 (16.91)	168.90 (9.70)	285.50 (17.20)	146.30 (3.73)	176.10 (8.67)	231.40 (18.38)			

B	5.23	(0.46)	5.17	(0.22)	4.95	(0.24)	6.21	(0.29)	5.74	(0.33)	5.99	(0.17)	7.09	(0.32)	6.04	(1.20)	5.46	(0.88)	3.01	(0.12)	3.88	(0.80)	4.21	(0.34)	3.97	(0.42)	6.38	(1.37)
Mo	6.47	(0.37)	13.79	(1.31)	20.82	(0.94)	9.32	(2.54)	17.60	(0.44)	19.72	(0.77)	11.65	(1.73)	13.95	(0.79)	15.21	(0.48)	23.49	(1.39)	14.72	(2.04)	21.89	(0.84)	24.33	(1.48)	26.62	(3.03)
<u>Ac 24</u>																												
P	0.52	(0.02)	0.62	(0.01)	0.59	(0.02)	0.56	(0.01)	0.48	(0.01)	0.47	(0.01)	0.39	(0.02)	0.45	(0.01)	0.66	(0.04)	0.59	(0.02)	0.55	(0.02)	0.55	(0.01)	0.51	(0.01)	0.52	(0.02)
K	3.13	(0.05)	3.27	(0.05)	2.90	(0.08)	2.90	(0.06)	2.77	(0.08)	2.50	(0.02)	2.35	(0.08)	3.47	(0.10)	4.73	(0.07)	4.27	(0.17)	4.37	(0.20)	4.23	(0.13)	3.47	(0.13)	4.03	(0.19)
Na	0.01	(0)	0.02	(0)	0.02	(0)	0.01	(0)	0.02	(0)	0.01	(0)	0.02	(0)	0.03	(0)	0.04	(0)	0.04	(0)	0.03	(0)	0.03	(0)	0.03	(0)	0.04	(0)
Ca	0.44	(0.02)	0.47	(0)	0.45	(0)	0.39	(0.01)	0.44	(0.01)	0.40	(0.01)	0.35	(0)	0.26	(0.01)	0.28	(0.03)	0.20	(0.01)	0.22	(0.02)	0.18	(0.01)	0.16	(0)	0.17	(0)
Mg	0.15	(0)	0.16	(0)	0.14	(0)	0.11	(0)	0.13	(0)	0.11	(0)	0.10	(0)	0.20	(0.01)	0.21	(0)	0.18	(0.01)	0.15	(0)	0.14	(0.01)	0.12	(0)	0.12	(0)
S	0.40	(0.01)	0.40	(0)	0.42	(0.01)	0.39	(0)	0.38	(0)	0.38	(0.01)	0.32	(0.01)	0.34	(0.01)	0.38	(0.01)	0.36	(0.01)	0.35	(0.01)	0.35	(0)	0.31	(0.01)	0.32	(0.01)
Mn	72.01	(7.63)	62.66	(0.70)	50.37	(1.94)	39.76	(2.37)	28.01	(0.44)	27.04	(1.56)	18.87	(0.87)	240.00	(7.87)	231.30	(10.86)	303.50	(17.64)	192.20	(26.60)	196.00	(12.34)	194.70	(11.52)	168.50	(9.96)
Fe	60.42	(1.01)	72.05	(2.03)	66.91	(0.60)	65.86	(0.58)	59.19	(1.93)	59.14	(2.20)	54.69	(1.39)	134.00	(2.41)	150.70	(9.19)	129.40	(3.32)	163.70	(7.99)	137.00	(0.65)	121.00	(4.04)	258.80	(11.98)
Cu	8.59	(0.30)	8.75	(0.15)	8.71	(0.15)	9.00	(0.36)	7.19	(0.17)	7.62	(0.32)	5.72	(0.14)	28.52	(3.69)	25.03	(2.08)	32.45	(0.42)	18.04	(0.57)	28.88	(3.83)	24.36	(2.04)	11.84	(0.58)
Zn	36.07	(2.19)	35.05	(0.76)	25.96	(0.52)	30.24	(2.08)	21.66	(0.17)	19.79	(0.56)	16.96	(0.43)	157.40	(21.11)	182.00	(8.08)	163.40	(5.56)	110.40	(6.63)	158.00	(5.35)	145.70	(2.41)	153.70	(7.44)
B	4.84	(0.18)	5.87	(0.13)	6.97	(0.23)	7.67	(0.32)	6.89	(0.09)	7.97	(0.31)	6.85	(0.14)	3.52	(0.17)	3.98	(0.34)	3.07	(0.19)	3.59	(0.48)	2.67	(0.13)	2.64	(0.12)	3.38	(0.12)
Mo	2.13	(0.07)	5.39	(0.14)	5.82	(0.24)	9.22	(1.55)	3.72	(0.05)	4.08	(0.26)	2.77	(0.14)	9.42	(1.16)	10.35	(0.70)	9.10	(0.58)	7.79	(0.19)	7.20	(0.11)	5.96	(0.33)	7.48	(0.16)