

Chemical elements and the quality of mānuka (*Leptospermum scoparium*) honey
Supplementary material

Table S1: Chemical characterization of soil at sites A-E.

site	A n=10	B n=14	C n=5	D n=5	E n=5
NH ₄ ⁺ -N	11 ± 3.9 ^a	17 ± 6.7 ^a	2.6 ± 0.61 ^a	11 ± 1.8 ^a	15 ± 4.6 ^a
NO ₃ ⁻ -N	5.6 ± 1.42 ^a	9.3 ± 1.5 ^{ab}	18 ± 2.1 ^b	12 ± 2.5 ^{ab}	13 ± 4.26 ^{ab}
pH	4.5 ± 0.11 ^{ab}	4.5 ± 0.09 ^{ab}	5.0 ± 0.06 ^b	4.8 ± 0.37 ^{ab}	4.2 ± 0.05 ^a
N (%)	0.36 ± 0.06 ^a	0.69 ± 0.03 ^b	0.25 ± 0.01 ^a	0.65 ± 0.18 ^b	0.32 ± 0.05 ^a
C (%)	4.9 ± 0.95 ^{ab}	11 ± 0.74 ^c	2.6 ± 0.08 ^b	7.5 ± 1.9 ^{ac}	5.2 ± 0.57 ^a
C/N	13 ± 0.33 ^b	16 ± 0.5 ^a	11 ± 0.33 ^c	12 ± 0.35 ^{bc}	17 ± 0.85 ^a
Al	31559 ± 2339 ^a	51646 ± 2115 ^b	30685 ± 610 ^a	40267 ± 3888 ^{ab}	36919 ± 5195 ^a
As	3.6 ± 0.66 ^b	4.0 ± 0.17 ^b	4.2 ± 0.23 ^b	4.0 ± 0.55 ^b	2.1 ± 0.26 ^a
B	27 ± 0.7 ^a	35 ± 1.3 ^b	47 ± 1.0 ^c	42 ± 5.0 ^{bc}	22 ± 3.00 ^a
Ca	1854 ± 337 ^a	1617 ± 126 ^a	5171 ± 75 ^c	4036 ± 1193 ^{bc}	1848 ± 135 ^{ab}
Cd	0.08 ± 0.01 ^a	0.22 ± 0.02 ^b	0.18 ± 0.02 ^{bc}	0.11 ± 0.02 ^{ac}	nd
Cr	21 ± 0.72 ^a	31 ± 2.5 ^b	26 ± 0.45 ^{ab}	28 ± 2.2 ^{ab}	21 ± 1.6 ^a
Cu	5.8 ± 0.72 ^a	11 ± 1.3 ^b	13 ± 0.27 ^b	5.7 ± 0.90 ^a	5.2 ± 0.93 ^a
Fe	13064 ± 316 ^a	19799 ± 368 ^b	13249 ± 60.7 ^a	14339 ± 1138 ^a	12427 ± 1086 ^a
K	3168 ± 169 ^a	3339 ± 314 ^a	8870 ± 521 ^b	9057 ± 1410 ^b	4860 ± 161 ^a
Li	24 ± 1.7 ^{ab}	36 ± 1.9 ^c	35 ± 0.28 ^{bc}	80 ± 7.1 ^d	19 ± 3.6 ^a
Mg	3910 ± 250 ^{ab}	4699 ± 200 ^{bc}	5499 ± 43 ^c	4841 ± 338 ^{bc}	3501 ± 395 ^a
Mn	236 ± 28 ^a	274 ± 23 ^a	356 ± 6.2 ^a	386 ± 121 ^a	185 ± 36 ^a
Na	276 ± 17 ^{ab}	217 ± 5.8 ^a	267 ± 7.0 ^{ab}	318 ± 54 ^b	224 ± 20 ^{ab}
Ni	8.0 ± 0.38 ^a	7.2 ± 0.39 ^a	15 ± 0.23 ^b	8.2 ± 0.60 ^a	7.5 ± 1.2 ^a
P	452 ± 59 ^b	664 ± 49 ^c	560 ± 27 ^{bc}	878 ± 140 ^c	152 ± 16 ^a
Pb	12 ± 0.52 ^a	19 ± 0.45 ^b	22 ± 1.2 ^{bc}	26 ± 1.9 ^c	11 ± 1.9 ^a
S	404 ± 76 ^a	664 ± 42 ^c	204 ± 12 ^b	892 ± 274 ^c	311 ± 33 ^{ab}
Sr	19 ± 1.3 ^b	24 ± 1.5 ^b	24 ± 0.72 ^{ab}	43 ± 12 ^a	37 ± 1.1 ^a
Zn	44 ± 2.0 ^a	45 ± 2.5 ^a	81 ± 1.5 ^b	81 ± 8.2 ^b	33 ± 5.7 ^a

Mean ± standard error. Different letters indicate significant differences between sites ($p \leq 0.05$). Values are in mg kg⁻¹ unless otherwise indicated.

nd=not detectable

Table S2: Soil exchangeable element concentrations at sites A-E.

site	A n=10	B 14	C 5	D 5	E 5
Al	121 ± 18 ^{ab}	250 ± 37 ^a	21 ± 5.3 ^c	84 ± 37 ^{bc}	154 ± 16 ^{ab}
Cd	<0.01 ± 0.00	<0.02 ± 0.00	<0.01 ± 0.00	nd	nd
Co	0.19 ± 0.05 ^{ac}	0.08 ± 0.03 ^b	0.59 ± 0.07 ^c	0.39 ± 0.16 ^{ac}	0.13 ± 0.04 ^{ab}
Cr	<0.02 ± 0.00 ^a	0.02 ± 0.00 ^a	0.00 ± 0.00 ^b	0.02 ± 0.01 ^a	0.01 ± 0.00 ^a
Cu	<0.03 ± 0.01 ^{ab}	0.02 ± 0.00 ^a	0.05 ± 0.01 ^b	0.02 ± 0.00 ^a	0.01 ± 0.00 ^a
Fe	28 ± 8.6 ^a	96 ± 23 ^b	2.6 ± 0.46 ^c	14 ± 9.8 ^{ac}	43 ± 13 ^{ab}
Li	0.08 ± 0.02 ^{ab}	0.06 ± 0.01 ^a	0.18 ± 0.01 ^{bc}	0.31 ± 0.06 ^c	0.10 ± 0.02 ^{abc}
Mg	223 ± 60 ^{ab}	155 ± 18 ^a	179 ± 14 ^{ab}	460 ± 162 ^b	262 ± 44 ^{ab}
Mn	26 ± 5.6 ^a	22 ± 2.3 ^a	22 ± 3.4 ^a	66 ± 21 ^a	31 ± 11 ^a
Na	73 ± 12 ^a	59 ± 4.4 ^a	26 ± 3.0 ^b	105 ± 27 ^a	96 ± 19 ^a
Ni	0.19 ± 0.04 ^{ab}	0.12 ± 0.01 ^a	0.39 ± 0.06 ^b	0.13 ± 0.05 ^a	0.11 ± 0.01 ^{ab}
P	2.9 ± 1.1 ^a	2.4 ± 0.22 ^{ab}	1.3 ± 0.11 ^a	5.0 ± 1.1 ^b	1.4 ± 0.21 ^a
Zn	1.6 ± 0.60 ^a	1.7 ± 0.38 ^a	2.3 ± 0.13 ^a	1.5 ± 0.47 ^b	1.5 ± 0.30 ^a

Mean ± standard error. Different letters indicate significant differences between sites (p≤0.05). Values are in mg kg⁻¹.

nd=not detectable

< actual mean is lower due to sample concentrations being below detection limit

Table S3: *L. scoparium* foliage elemental concentrations at sites A-E.

site	A n= 10	B 15	C 5	D 5	E 5
N (%)	1.0 ± 0.07 ^a	0.99 ± 0.06 ^a	1.03 ± 0.06 ^a	0.97 ± 0.07 ^a	1.1 ± 0.04 ^a
C (%)	49 ± 0.31 ^a	49 ± 0.24 ^a	50 ± 0.39 ^a	49 ± 0.33 ^a	49 ± 0.30 ^a
C/N	49 ± 3.4 ^a	52 ± 2.9 ^a	49 ± 2.4 ^a	52 ± 4.2 ^a	46 ± 2.1 ^a
Al	212 ± 61 ^a	105 ± 22 ^a	26 ± 4.5 ^b	132 ± 29 ^a	72 ± 15 ^{ab}
As	<0.16 ± 0.05 ^a	<0.24 ± 0.04 ^a	<0.12 ± 0.05 ^a	0.29 ± 0.06 ^a	0.21 ± 0.03 ^a
B	24 ± 1.6 ^a	21 ± 1.3 ^a	19 ± 2.3 ^a	19 ± 1.1 ^a	22 ± 1.1 ^a
Ca	4610 ± 466 ^a	4584 ± 349 ^a	4102 ± 365 ^a	5640 ± 539 ^a	4548 ± 524 ^a
Cd	<0.05 ± 0.01 ^a	<0.06 ± 0.02 ^a	<0.04 ± 0.01 ^a	<0.07 ± 0.02 ^a	<0.03 ± 0.02 ^a
Co	<0.05 ± 0.01 ^a	<0.01 ± 0.00 ^b	0.08 ± 0.02 ^a	<0.04 ± 0.01 ^{ab}	0.12 ± 0.05 ^a
Cr	4.5 ± 2.2 ^a	0.63 ± 0.08 ^b	0.43 ± 0.16 ^b	1.1 ± 0.28 ^{ab}	0.81 ± 0.10 ^{ab}
Cu	4.1 ± 0.50 ^a	3.9 ± 0.32 ^a	3.3 ± 0.42 ^a	2.7 ± 0.25 ^a	4.6 ± 0.60 ^a
Fe	214 ± 57 ^c	84 ± 16 ^{ab}	36 ± 4.3 ^a	128 ± 29 ^{bc}	66 ± 12 ^{ab}
K	3887 ± 168 ^{bc}	3958 ± 124 ^b	5015 ± 342 ^d	3080 ± 159 ^{ac}	3000 ± 289 ^a
Li	0.29 ± 0.09 ^a	0.08 ± 0.02 ^b	0.22 ± 0.05 ^a	0.39 ± 0.06 ^a	0.14 ± 0.03 ^{ab}
Mg	1009 ± 40 ^c	927 ± 36 ^c	1094 ± 106 ^{ac}	1468 ± 102 ^b	1397 ± 112 ^{ab}
Mn	322 ± 53 ^{bc}	169 ± 13 ^b	74 ± 8.7 ^d	448 ± 115 ^{ac}	874 ± 165 ^a
Na	2435 ± 212 ^{ab}	2054 ± 154 ^{abc}	1634 ± 153 ^{bc}	1415 ± 163 ^c	2819 ± 252 ^a
Ni	4.3 ± 1.1 ^a	1.8 ± 0.31 ^a	2.6 ± 0.34 ^a	3.7 ± 1.8 ^a	4.1 ± 1.8 ^a
P	601 ± 47 ^{ab}	561 ± 30 ^a	633 ± 48 ^{ab}	771 ± 84 ^b	429 ± 40 ^a
S	934 ± 49 ^b	926 ± 59 ^b	685 ± 47 ^b	814 ± 74 ^b	1254 ± 103 ^a
Sr	24 ± 3.0 ^b	35 ± 2.5 ^{ab}	21 ± 2.3 ^b	37 ± 5.1 ^{ab}	43 ± 9.8 ^a
Zn	21 ± 1.8 ^a	23 ± 1.7 ^a	17 ± 1.9 ^a	26 ± 5.5 ^a	25 ± 2.1 ^a

Mean ± standard error. Different letters indicate significant differences between sites ($p \leq 0.05$). Values are in mg kg^{-1} unless otherwise indicated.

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