Table 1. Chemical and physical properties of soil from 30 yerba mate collection sites in three states in southern Brazil.

Id[a]	pH	Al	H+Al	Ca	Mg	K	CEC	P	Cu	Mn	Fe	Zn	OC	Clay	Silt
		---------- cmolc dm^{-3} ----------						---------- mg dm^{-3} ----------					--------- % ------		
1	4.2	2.5	7.2	0.3	0.2	0.07	7.77	1.3	2.4	19	133	1.1	1.3	21	9
2	4.2	3.9	10.5	0.3	0.1	0.16	11.1	1.3	7.6	5	101	1.6	2.0	48	14
3	4.6	2.1	7.8	3.4	1.4	0.15	12.7	0.6	10.7	42	107	2.5	1.6	70	23
4	4.2	5.1	12.1	0.4	0.3	0.13	12.9	1.6	8.4	18	15	2.9	2.6	81	16
5	4.1	3.5	12.1	1.2	0.6	0.30	14.2	1.8	2.7	46	116	1.5	3.4	60	20
6	3.8	8.5	16.3	0.4	0.1	0.25	17.0	2.5	2.4	56	183	1.5	2.6	66	29
7	3.8	8.6	16.3	0.4	0.1	0.20	17.0	4.6	1.7	12	199	1.1	4.3	60	33
8	3.9	7.5	15.2	0.7	0.4	0.28	16.6	1.8	1.1	17	83	0.4	3.7	54	34
9	4.0	3.6	10.5	0.4	0.1	0.13	11.1	0.9	1.3	18	110	0.4	2.6	28	26
10	4.0	2.7	10.5	0.4	0.1	0.11	11.1	1.1	1.4	8	123	0.5	2.6	38	25
11	3.9	6.1	13.1	1.8	0.4	0.32	15.6	2.7	0.7	47	201	1.8	2.2	33	36
12	4.1	4.1	12.1	1.4	0.5	0.17	14.2	0.6	1.8	22	49	0.9	1.3	69	16
13	3.9	7.1	14.1	0.8	0.3	0.18	15.4	1.6	1.1	56	95	1.7	2.1	54	38
14	3.7	9.5	16.3	0.8	0.1	0.28	17.5	1.5	1.5	19	167	0.4	3.4	65	29
15	4.5	1.3	7.8	4.0	0.9	0.18	12.9	1.8	8.0	51	50	1.8	3.7	73	19
16	4.0	4.6	13.1	1.2	0.5	0.44	15.2	1.5	6.8	68	79	1.5	3.3	75	20
17	3.5	5.6	15.2	0.6	0.1	0.29	16.2	2.2	5.9	44	215	1.0	3.2	61	30
18	4.0	9.9	15.2	1.3	0.6	0.29	17.4	1.5	2.2	20	85	1.0	4.0	70	24
19	4.1	3.7	13.1	0.4	0.2	0.14	13.8	4.8	nd	nd	nd	nd	2.6	68	21
20	3.9	5.7	16.3	0.3	0.4	0.15	17.1	2.5	nd	nd	nd	nd	2.9	46	36
21	3.9	7.6	16.3	0.6	0.4	0.22	17.5	4.2	nd	nd	nd	Nd	2.1	58	29
22	4.1	2.1	10.5	0.3	0.1	0.12	11.0	2.5	nd	nd	nd	nd	2.1	43	16
23	4.7	0.2	8.4	6.3	2.3	0.81	17.8	134	9.9	162	38	23	1.8	66	24
24	3.8	5.3	16.3	0.6	0.3	0.09	17.3	1.5	6.5	94	73	1.2	1.4	75	18
25	3.8	4.6	15.2	0.7	0.5	0.12	16.5	0.7	4.1	75	74	1.3	1.6	81	15
26	3.9	5.8	17.6	0.9	0.3	0.21	19.0	6.0	0.6	29	39	1.2	4.3	24	48
27	4.2	2.4	11.3	2.3	0.2	0.17	14.0	7.3	1.2	103	18	2.6	1.4	28	46
28	4.5	0.8	7.8	3.2	1.1	0.35	12.4	3.3	1.5	128	91	5.8	1.6	35	44
29	4.1	3.1	12.1	3.0	1.0	0.38	16.5	2.2	1.6	150	109	4.8	2.1	49	26
30	3.9	5.2	17.6	1.1	0.5	0.24	19.4	4	8.4	60	148	3.1	4.0	69	26

[a]1,2: União da Vitória; 3,4: Bituruna; 5, 8: São Mateus do Sul; 6,7: Mallet; 9, 10: São João do Triunfo; 11: Itaiópolis; 12, 13: Três Barras; 14: Canoinhas; 15: Vargem Bonita; 16: Catanduvas; 17:Lebon Regis; 18: Rebouças; 19: Guarapuava; 20: Prudentópolis; 21: Irati; 22: Imbituva; 23:Barrão de Cotegipe; 24: Erechim; 25: Getúlio Vargas; 26, 28: Ilópolis; 27: Putinga; 29: Anta Gorda; 30: Cruz Machado. pH: pH $CaCl_2$. nd: Not-determined. OC: Organic Carbon. CEC: Cation exchange capacity at pH 7.

Table 2. Range variation (minimum – maximum) and mean elemental composition of washed and unwashed yerba mate leaves (mg kg^{-1}), and t-test between washed and unwashed samples from southern Brazil.

Element	Unwashed			Washed		
	Mean	Minimum	Maximum	Mean	Minimum	Maximum
Ag			<BDL			<BDL
Al	522	312	742	475	271	706
As	0.032	0.014	0.056	0.022	0.009	0.042
B	51.5	28.9	91.4	49.9	29.4	80.5
Ba	65.3	40.9	96.0	64.4	32.5	97.5
Be	0.024	0.003	0.108	0.023	0.002	0.120
Ca	7750	6142	10878	7538	5955	10768
Cd	0.288	0.094	0.844	0.272	0.077	0.856
Co	0.120	<BDL	0.407	0.106	<BDL	0.380
Cr			<BDL			<BDL
Cs	0.564	0.021	3.823	0.558	0.019	3.768
Cu	9.8	6.2	13.5	9.7	7.3	14.0
Fe	98.3	51.1	169.1	65.7	33.9	148.3
K	16771	9709	27035	16251	10289	25319
Li	0.063	0.025	0.239	0.045	0.017	0.188
Mg	6506	3869	9231	6275	3681	8921
Mn	3122	1136	10044	3089	1180	9401
Mo	0.110	<BDL	0.442	0.081	<BDL	0.394
Na	19.2	<BDL	103.6	27.9	<BDL	105.9
Ni	3.834	0.494	6.698	3.598	0.402	6.760
P	1062	807	2084	1027	762	1939
Pb	0.257	<BDL	0.602	0.209	<BDL	0.475
Rb	47	14	124	46	14	132
S	1820	1559	2061	1741	1364	2442
Se	0.027	<BDL	0.078	0.024	<BDL	0.071
Sr	44.8	13.8	87.2	44.1	15.0	88.9
Ti	3.404	2.187	4.690	2.616	1.935	3.386
Tl	0.019	<BDL	0.053	0.017	<BDL	0.044
U			<BDL			<BDL
V	0.192	0.074	0.341	0.113	<BDL	0.220
Zn	67	16	179	65	14	192

BDL: Below detection limit.

Table 3. Elemental means used in Linear Discriminant Analysis of leaves and soil (mg kg^{-1}), and Kruskal Wallis test results, followed by Dunn's Test when $p<0.05$.

Parent material	Mn		P		Co		Ni		Mg	Al		Fe		K		Na		Ca		Ba	
Yerba mate leaves																					
Basalt	4497	A	1132	A	0.23	A	3.9	A	5852	n.s.	437	B	58	C	14036	C	18.8	C	7691	n.s.	70	n.s.
Rhyolite/Rhyodacite	2153	B	992	B	0.06	B	1.3	B	6085		452	AB	75	A	21636	A	54.5	A	7893		70	
Sedimentary	2442	B	970	B	0.04	B	4.0	A	6588		504	A	68	B	16288	B	27.0	B	7353		60	
Soil pseudototal																						
Basalt	1058	A	1004	A	42	A	40	A	1184	n.s.	67979	n.s.	132647	A	1063	B	140	B	387	B	63	B
Rhyolite/Rhyodacite	1310	A	653	AB	13	B	5	B	1818		50868		44660	B	9005	A	2530	A	1232	A	281	A
Sedimentary	210	B	412	B	4	B	14	B	1730		57625		37990	B	3787	B	147	B	209	B	102	B

15 Table S1. General information describing the 30 sampling sites: municipality, state, geologic

16 formation, management, declivity, growth condition, altitude, and soil color.

Id	Municipality	State	Geologic	Management	Declivity	Origin
1	União da Vitoria	PR	Sandstone	Forest - pasture	undulate	Native and planted
2	União da Vitoria	PR	Sediment	Forest - pasture	undulate	Native and planted
3	Bituruna	PR	Basalt	Forest	undulate	Native and planted
4	Bituruna	PR	Basalt	Forest - pasture	smooth undulate	Native
5	São Mateus do Sul	PR	Shale	Forest - pasture	smooth undulate	Native
6	Mallet	PR	Sediment	Forest	smooth undulate	Native
7	Mallet	PR	Sediment	Forest - pasture	smooth undulate	Native
8	São Mateus do Sul	PR	Sediment	Forest - pasture	smooth undulate	Native
9	São João do Triunfo	PR	Sandstone	Forest - pasture	smooth undulate	Native
10	São João do Triunfo	PR	Sandstone	Forest - pasture	smooth undulate	Native
11	Itaiópolis	SC	Sediment	Forest	undulate	Native
12	Três Barras	SC	Sediment	Forest	smooth undulate	Native
13	Três Barras	SC	Sediment	Forest	undulate	Native
14	Canoinhas	SC	Sediment	Forest - pasture	smooth undulate	Native
15	Vargem Bonita	SC	Basalt	Forest - pasture	undulate	Native
16	Catanduvas (basalto)	SC	Basalt	Forest	smooth undulate	Native
17	Lebon Régis	SC	Basalt	Forest	smooth undulate	Native
18	Rebouças	PR	Sediment	Forest - pasture	smooth undulate	Native
19	Guarapuava	PR	Basalt	Forest	smooth undulate	Native
20	Prudentolopis	PR	Sediment	Forest - pasture	smooth undulate	Native
21	Irati	PR	Sediment	Forest - pasture	undulate	Native
22	Imbituva	PR	Sediment	Forest	smooth undulate	Native
23	Barrão do Cotegipe	RS	Basalt	Erva organic	undulate	Planted
24	Erechim	RS	Basalt	Forest	smooth undulate	Planted
25	Getulio Vargas	RS	Basalt	Forest	smooth undulate	Native and planted
26	Ilópolis	RS	Rhyodacites	Forest	undulate	Native
27	Putinga	RS	Rhyodacites	Forest	undulate	Native and planted
28	Ilópolis	RS	Rhyodacites	Forest	smooth undulate	Native
29	Anta Gorda	RS	Rhyodacites	Forest	Strong undulate	Native
30	Cruz Machado	PR	Basalt	Forest - pasture	smooth undulate	Native

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Table S2. Limits of detection (LOD), percent recovery (%) and measured and certified values (mg kg^{-1}) of Tomato standard (Tomato 1573A CRM).

Element	LOD	Measured	Certified	%	Element	LOD	Measured	Certified	%
Ag	0.030	0.01	-*	-	Mg	18.026	10067	12000	84
Al	4.418	436	598	73	Mn	0.912	226	246	92
As	0.005	0.17	0.11	155	Mo	0.051	0.45	0.46	98
B	2.099	29.6	33.3	89	Na	19.566	94	136	69
Ba	0.067	69	63	109	Ni	0.322	1.47	1.59	92
Be	0.001	0.028	-	-	P	8.867	2238	2160	104
Ca	1.868	49121	50500	97	Pb	0.135	0.541	-	-
Cd	0.008	1.49	1.52	98	Rb	0.010	15.34	14.89	103
Co	0.092	0.52	0.57	92	S	240.281	9858	9600	103
Cr	0.936	1.71	1.99	86	Se	0.012	0.084	0.054	156
Cs	0.001	0.055	0.053	104	Sr	3.566	95	85	111
Cu	0.699	3.6	4.7	77	Ti	0.006	15.79	-	-
Fe	11.99	362	368	98	Tl	0.009	0.04	-	-
K	7.975	26510	27000	98	U	0.085	0.029	0.035	83
Li	0.009	0.521			V	0.071	0.704	0.835	84
					Zn	8.054	26.6	30.9	86

* without certified value

Table S3. Elemental composition of washed yerba mate leaf samples from 30 collection sites in three states in southern Brazil. Means and standard deviation of four samples (mg kg^{-1}).

Site[a]	Al	As	B	Ba	Be	Ca	Cd	Co	Cr	Cs	Cu	Fe	K	Li	Mg
1	353±106	0.042±0.010	29±7	50±10	0.005±0.002	7076±651	0.121±0.023	<BDL	<BDL	0.594±0.177	11.1±2.1	81±22	14159±784	0.030±0.007	5989±680
2	515±52	0.022±0.005	43±11	41±13	0.013±0.003	5955±1364	0.077±0.013	<BDL	<BDL	0.316±0.111	8.2±0.5	67±5	15383±1411	0.027±0.002	4117±546
3	389±52	0.012±0.003	34±5	78±20	0.009±0.004	7845±1251	0.468±0.238	0.150±0.062	<BDL	0.652±0.416	8.7±1.0	40±2	10444±2148	0.025±0.004	7000±991
4	452±52	0.012±0.004	31±3	47±19	0.005±0.001	6181±537	0.161±0.018	<BDL	<BDL	1.052±0.317	9.1±1.3	43±6	10515±2088	0.022±0.003	5196±864
5	706±164	0.040±0.013	72±12	56±11	0.023±0.007	6735±280	0.099±0.007	<BDL	<BDL	0.584±0.12	8.7±0.7	87±16	10289±3018	0.057±0.015	8806±889
6	510±16	0.041±0.006	37±4	57±21	0.010±0.002	7210±892	0.243±0.059	0.107±0.032	<BDL	0.129±0.016	8.5±0.9	148±39	18252±1631	0.188±0.026	5863±489
7	489±40	0.014±0.003	44±1	32±8	0.011±0.001	5995±1701	0.230±0.022	<BDL	<BDL	0.194±0.015	10.5±2.6	53±7	17420±3519	0.042±0.007	4462±1881
8	530±44	0.026±0.003	45±5	57±17	0.039±0.013	6095±563	0.112±0.013	<BDL	<BDL	0.103±0.032	8.8±1.3	65±4	18028±562	0.027±0.005	5706±614
9	636±123	0.026±0.004	57±15	74±26	0.042±0.006	8254±1372	0.105±0.028	<BDL	<BDL	0.394±0.112	7.8±0.6	73±7	12746±3098	0.041±0.006	7313±1859
10	373±104	0.017±0.006	43±10	53±16	0.013±0.006	6793±1237	0.165±0.037	<BDL	<BDL	0.699±0.361	11.0±0.6	64±4	23272±2266	0.029±0.009	6702±1041
11	413±77	0.023±0.007	45±13	48±9	0.028±0.028	7551±1413	0.320±0.074	<BDL	<BDL	0.019±0.004	7.8±1.0	55±11	15870±2354	0.076±0.021	5093±494
12	271±78	0.009±0.003	33±5	63±11	0.004±0.001	7778±700	0.087±0.020	<BDL	<BDL	1.477±0.926	10.8±0.7	34±4	24795±4825	0.025±0.013	7640±964
13	427±86	0.018±0.001	39±6	80±26	0.038±0.019	8077±1376	0.368±0.167	<BDL	1.42±1.51	0.069±0.011	8.7±1.4	51±5	18355±3483	0.033±0.003	7187±863
14	553±141	0.016±0.010	58±23	42±7	0.015±0.004	6777±786	0.411±0.094	<BDL	<BDL	0.152±0.059	8.9±1.1	65±9	15104±2438	0.058±0.024	4042±407
15	448±40	0.015±0.003	61±11	97±12	0.022±0.003	8901±446	0.286±0.119	0.380±0.146	<BDL	0.805±0.287	11.4±1.1	53±5	10949±2306	0.035±0.006	7927±1048
16	602±139	0.017±0.003	59±6	96±21	0.013±0.004	10768±1698	0.471±0.090	0.372±0.134	<BDL	0.291±0.184	11.3±2.0	49±5	16127±1936	0.031±0.011	6031±607
17	338±32	0.009±0.003	52±5	46±15	0.002±0.001	6981±1539	0.211±0.071	0.194±0.144	<BDL	0.129±0.047	7.6±1.1	51±8	13112±2737	0.035±0.011	3693±591
18	566±86	0.022±0.007	50±2	66±15	0.037±0.010	9240±829	0.321±0.093	<BDL	<BDL	0.057±0.018	9.0±1.9	60±6	13243±2292	0.03±0.002	8921±1610
19	391±41	0.010±0.005	42±8	50±8	0.003±0.001	6879±492	0.167±0.052	<BDL	<BDL	0.358±0.136	12.8±2.6	49±5	21242±1194	0.017±0.002	4753±311
20	514±58	0.022±0.005	46±10	79±14	0.025±0.003	8238±1139	0.121±0.028	<BDL	<BDL	0.139±0.042	9.6±1.6	59±5	11371±1196	0.041±0.006	8272±926
21	567±66	0.020±0.005	49±4	76±12	0.026±0.002	8464±975	0.518±0.168	<BDL	<BDL	0.075±0.021	8.8±1.4	68±11	20083±1511	0.04±0.003	7122±1198
22	638±74	0.016±0.007	67±20	78±22	0.027±0.003	7410±1496	0.093±0.017	<BDL	<BDL	0.913±0.203	8.6±1.6	61±11	12240±1719	0.029±0.006	8169±1266
23	393±110	0.030±0.009	80±30	59±11	0.046±0.019	6467±872	0.341±0.111	0.359±0.119	<BDL	0.103±0.045	7.7±2.0	67±8	19368±1634	0.046±0.024	5065±746
24	461±93	0.034±0.006	57±7	91±24	0.015±0.004	6646±1531	0.262±0.054	0.364±0.193	<BDL	3.768±0.402	11.5±2.5	87±8	10616±2414	0.041±0.006	4952±1404
25	407±51	0.026±0.011	80±10	89±31	0.009±0.002	8114±1268	0.417±0.106	0.187±0.049	<BDL	1.446±0.447	9.6±1.7	78±13	14312±2644	0.056±0.019	8249±1368
26	448±80	0.023±0.004	56±9	73±10	0.044±0.011	9060±1270	0.188±0.026	<BDL	<BDL	0.569±0.095	7.3±1.0	76±7	19663±1670	0.059±0.004	7374±763
27	330±32	0.030±0.006	34±10	53±32	0.022±0.005	6732±2038	0.856±0.434	<BDL	<BDL	0.111±0.012	11.2±1.4	65±7	25319±3738	0.056±0.022	6258±1919
28	517±104	0.033±0.007	53±5	55±11	0.022±0.014	8169±1311	0.464±0.083	<BDL	<BDL	0.909±0.149	14.0±0.4	74±9	20535±2650	0.061±0.019	3681±1249
29	514±64	0.025±0.005	50±12	96±9	0.120±0.084	7610±777	0.284±0.069	0.126±0.078	<BDL	0.137±0.025	10.3±1.0	85±5	21028±1379	0.066±0.005	7027±966
30	489±68	0.012±0.005	50±11	49±24	0.009±0.002	8126±1428	0.198±0.031	0.134±0.027	<BDL	0.495±0.071	11.0±1.3	63±10	13680±1340	0.029±0.002	5654±1291

[a]1,2: União da Vitória; 3,4: Bituruna; 5, 8: São Mateus do Sul; 6,7: Mallet; 9, 10: São João do Triunfo; 11: Itaiópolis; 12, 13: Três Barras; 14: Canoinhas; 15: Vargem Bonita; 16: Catanduvas; 17: Lebon Regis; 18: Rebouças; 19: Guarapuava; 20: Prudentópolis; 21: Irati; 22: Imbituva; 23: Barrão de Cotegipe; 24: Erechim; 25: Getúlio Vargas; 26, 28: Ilópolis; 27: Putinga; 29: Anta Gorda; 30: Cruz Machado.

Table S3. Elemental composition of washed yerba mate leaf samples from 30 collection sites in three states in southern Brazil. Means and standard deviation of four samples (mg kg^{-1}). (continued)

Site[a]	Mn	Mo	Na	Ni	P	Pb	Rb	S	Se	Sr	Ti	Tl	V	Zn
1	2429±1009	0.093±0.050	29±2	1.99±0.75	993±61	<BDL	35±5.2	1605±139	0.029±0.005	56±12.7	3.4±0.71	<BDL	0.186±0.074	38±24
2	1696±525	0.078±0.015	30±3	5.60±0.99	1093±155	<BDL	37±5.3	1471±61	0.029±0.003	41±11.9	2.6±0.41	<BDL	0.144±0.011	16±4
3	5604±2238	<BDL	26±2	2.07±0.78	910±17	<BDL	31±8.0	1506±103	0.028±0.004	23±6.5	2.4±0.31	0.044±0.021	<BDL	192±113
4	3185±708	0.122±0.044	25±2	5.20±1.78	973±30	<BDL	31±4.8	1364±73	0.022±0.004	38±10.0	2.0±0.06	0.013±0.004	<BDL	49±11
5	1193±169	0.170±0.056	37±3	2.59±0.40	963±98	0.390±0.226	16±4.4	2442±1213	0.071±0.046	37±6.2	2.3±0.18	0.018±0.005	0.158±0.048	14±3
6	4302±557	0.059±0.019	29±2	1.94±0.56	1054±40	0.235±0.026	55±9.1	1712±13	0.040±0.039	34±6.0	2.9±0.31	0.021±0.009	0.220±0.029	79±22
7	2008±137	0.071±0.007	33±5	4.08±1.85	882±63	<BDL	72±14.1	1607±36	0.019±0.001	27±6.4	1.9±0.49	<BDL	0.073±0.004	50±24
8	1237±170	0.093±0.013	29±1	3.32±1.09	1061±67	0.211±0.089	44±8.9	1799±163	0.015±0.002	65±3.9	2.0±0.21	0.010±0.004	0.100±0.011	49±4
9	2313±327	0.078±0.016	41±18	5.09±2.06	1175±363	0.469±0.204	33±11.5	1711±318	0.033±0.013	70±17.4	2.6±0.46	0.011±0.005	0.132±0.016	27±20
10	1405±295	0.053±0.026	25±3	5.76±1.95	1432±143	0.229±0.201	68±9.5	2086±96	<BDL	52±15.8	2.2±0.21	0.028±0.010	0.075±0.015	137±39
11	2793±368	<BDL	49±20	3.65±1.56	803±87	<BDL	15±2.7	1628±77	0.022±0.003	22±7.1	2.5±0.37	<BDL	0.096±0.031	28±8
12	1852±690	<BDL	24±4	2.42±1.09	888±155	<BDL	132±41.1	1844±241	0.013±0.002	78±9.5	2.2±0.27	<BDL	<BDL	41±16
13	3357±489	0.084±0.049	26±3	5.91±1.03	762±38	0.151±0.050	60±5.4	1599±87	0.024±0.004	46±7.6	2.6±0.27	<BDL	0.084±0.012	31±8
14	4672±1090	<BDL	<BDL	4.50±2.00	892±43	0.145±0.040	29±8.5	1706±66	0.020±0.002	25±4.0	2.6±0.48	0.010±0.004	0.102±0.021	27±14
15	2481±406	0.054±0.010	<BDL	4.15±0.93	1110±17	<BDL	26±7.3	1969±161	0.036±0.007	27±2.6	2.8±0.20	0.020±0.012	0.085±0.013	100±26
16	6015±1054	<BDL	<BDL	5.75±1.85	998±48	0.258±0.104	33±12.3	1847±136	0.017±0.002	22±6.5	3.1±0.49	0.033±0.024	<BDL	168±95
17	9401±1591	<BDL	23±6	1.97±0.77	888±43	<BDL	33±14.3	1721±117	0.013±0.004	21±3.9	2.2±0.32	<BDL	<BDL	54±27
18	2264±294	<BDL	<BDL	5.22±1.06	806±32	0.423±0.190	27±1.1	1616±66	0.021±0.011	64±12.7	2.9±0.22	0.014±0.005	0.101±0.017	36±9
19	2477±212	<BDL	<BDL	6.15±1.31	1161±268	<BDL	52±11.8	1748±13	0.012±0.004	27±2.5	2.2±0.07	<BDL	<BDL	49±7
20	2959±615	0.081±0.007	<BDL	3.03±0.96	981±57	0.193±0.109	32±6.5	1844±115	0.040±0.035	89±17	2.6±0.26	0.010±0.004	0.103±0.009	63±18
21	2915±654	<BDL	<BDL	2.56±0.56	857±57	0.475±0.346	43±7.4	1776±102	0.013±0.002	62±5.5	3.3±0.50	0.028±0.014	0.124±0.022	94±34
22	1684±206	0.074±0.030	<BDL	6.76±2.45	874±44	0.232±0.106	21±3.9	1605±96	0.021±0.006	66±15.4	2.5±0.37	0.019±0.004	0.105±0.031	39±11
23	3002±483	0.394±0.127	<BDL	1.15±0.55	1939±294	0.149±0.049	14±2.9	1480±50	<BDL	15±1.7	2.5±0.41	0.010±0.004	0.147±0.016	141±66
24	3952±396	<BDL	38±37	5.87±2.68	1313±146	0.167±0.062	36±6.8	1923±153	0.019±0.006	34±6.6	2.9±0.48	0.042±0.033	0.19±0.031	50±22
25	5270±493	0.059±0.016	<BDL	2.72±0.68	1102±47	0.181±0.080	37±4.0	1853±106	0.027±0.013	37±9.2	3.3±0.50	0.040±0.022	0.173±0.044	66±14
26	2214±458	0.072±0.027	106±40	0.40±0.07	957±71	0.267±0.084	81±11.2	1789±66	0.015±0.001	52±3.2	3.3±0.45	0.017±0.013	0.143±0.013	44±23
27	1180±514	0.071±0.030	45±7	0.90±0.45	878±56	<BDL	93±22.3	1619±102	0.015±0.003	31±12.4	2.3±0.52	<BDL	0.092±0.004	56±37
28	3171±965	0.221±0.038	41±7	1.85±0.43	1326±166	0.171±0.025	117±27.3	1865±93	0.038±0.006	41±8.5	2.9±0.32	0.015±0.012	0.13±0.016	86±23
29	2046±610	0.118±0.054	26±3	1.86±0.71	806±6	0.207±0.021	59±12.9	1716±71	0.020±0.002	63±12.8	3.1±0.07	0.025±0.006	0.172±0.024	57±15
30	3582±624	<BDL	<BDL	3.47±1.13	926±41	<BDL	28±1.3	1782±28	0.013±0.002	60±36.5	2.5±0.24	0.020±0.011	0.096±0.018	63±6

[a]1,2: União da Vitória; 3,4: Bituruna; 5, 8: São Mateus do Sul; 6,7: Mallet; 9, 10: São João do Triunfo; 11: Itaiópolis; 12, 13: Três Barras; 14: Canoinhas; 15: Vargem Bonita; 16: Catanduvas; 17: Lebon Regis; 18: Rebouças; 19: Guarapuava; 20: Prudentópolis; 21: Irati; 22: Imbituva; 23: Barrão de Cotegipe; 24: Erechim; 25: Getúlio Vargas; 26, 28: Ilópolis; 27: Putinga; 29: Anta Gorda; 30: Cruz Machado.

Table S4. Elemental composition of unwashed yerba mate leaf samples from 30 collection sites in three states in southern Brazil. Means and standard deviation of four samples (mg kg^{-1}).

Site[a]	Al	As	B	Ba	Be	Ca	Cd	Co	Cr	Cs	Cu	Fe	K	Li	Mg
1	383±109	0.053±0.012	29±5	53±10	0.005±0.003	7509±419	0.145±0.024	<BDL	<BDL	0.560±0.151	11.3±1.5	107±29	13697±1526	0.037±0.011	6197±869
2	537±82	0.023±0.006	44±11	44±13	0.013±0.003	6142±1476	0.096±0.021	<BDL	<BDL	0.325±0.111	7.7±1.0	81±15	15524±1075	0.031±0.005	4162±581
3	389±52	0.018±0.009	33±5	79±24	0.007±0.004	7838±1376	0.502±0.247	0.144±0.064	<BDL	0.650±0.420	8.3±1.2	51±7	11224±2354	0.027±0.004	6932±1254
4	444±41	0.014±0.004	31±3	54±18	0.005±0.001	6826±675	0.206±0.029	<BDL	1.24±0.19	1.139±0.425	9.0±1.3	53±2	11023±1738	0.025±0.006	5456±831
5	742±204	0.056±0.012	71±9	68±12	0.023±0.009	7444±722	0.127±0.013	<BDL	1.41±0.61	0.600±0.089	8.8±0.8	135±32	9709±2337	0.089±0.022	9201±1038
6	577±72	0.048±0.012	37±7	59±27	0.011±0.002	7414±706	0.278±0.075	0.113±0.032	1.45±0.15	0.139±0.025	8.8±1.4	169±19	19481±3010	0.239±0.045	6149±623
7	492±54	0.020±0.003	44±3	41±8	0.013±0.002	6658±1668	0.298±0.035	<BDL	<BDL	0.204±0.004	10.5±2.8	69±1	17202±3391	0.053±0.005	4797±1790
8	578±69	0.034±0.009	46±5	59±17	0.041±0.010	6400±490	0.125±0.020	<BDL	<BDL	0.103±0.033	8.9±1.3	92±7	18889±369	0.041±0.009	5928±688
9	624±167	0.028±0.006	53±17	82±35	0.038±0.009	8734±1998	0.127±0.014	<BDL	1.47±0.19	0.413±0.093	7.7±0.7	88±11	13763±2501	0.045±0.006	7159±1812
10	371±79	0.021±0.004	43±11	51±13	0.013±0.005	6710±888	0.168±0.031	<BDL	<BDL	0.710±0.324	11.5±0.5	82±6	23927±2422	0.040±0.011	6758±741
11	426±54	0.023±0.007	44±12	53±6	0.026±0.024	8050±1056	0.393±0.069	<BDL	1.34±0.22	0.021±0.004	8.1±1.1	80±15	16980±2805	0.091±0.015	5367±352
12	312±83	0.017±0.005	34±6	64±10	0.005±0.001	8080±1205	0.094±0.033	<BDL	<BDL	1.384±0.752	11.0±0.5	55±6	24347±3599	0.038±0.016	8044±1154
13	493±112	0.025±0.009	39±6	84±25	0.040±0.019	8438±1359	0.393±0.186	<BDL	<BDL	0.075±0.012	9.2±1.7	78±9	18599±3761	0.054±0.008	7595±1084
14	624±141	0.029±0.005	63±25	43±8	0.016±0.003	6968±548	0.416±0.081	<BDL	1.13±0.38	0.162±0.066	10.1±1.5	99±11	15864±2844	0.067±0.012	4260±345
15	480±53	0.022±0.004	59±11	95±11	0.023±0.004	8812±586	0.303±0.116	0.393±0.142	<BDL	0.841±0.316	12.0±1.4	74±3	11486±1916	0.048±0.012	7959±989
16	662±106	0.029±0.006	62±7	96±21	0.013±0.003	10878±1694	0.506±0.100	0.399±0.151	<BDL	0.299±0.190	12.3±2.1	90±16	16868±2507	0.053±0.012	6203±761
17	394±48	0.022±0.005	53±5	42±10	0.003±0.001	7003±1494	0.211±0.082	0.198±0.149	<BDL	0.127±0.043	8.5±1.2	79±8	13230±2305	0.047±0.011	3983±591
18	661±62	0.039±0.012	53±4	71±15	0.038±0.008	9930±1383	0.388±0.076	<BDL	<BDL	0.069±0.022	9.9±1.5	118±13	14185±1928	0.068±0.009	9231±1476
19	455±62	0.014±0.005	46±9	51±7	0.004±0.001	7002±545	0.196±0.063	<BDL	<BDL	0.392±0.137	13.2±2.7	72±9	21573±2456	0.029±0.002	5158±518
20	584±65	0.031±0.002	48±10	78±15	0.027±0.004	8277±972	0.139±0.037	<BDL	0.98±0.18	0.150±0.044	10.3±1.8	116±38	12116±1633	0.067±0.006	8497±1063
21	656±107	0.041±0.011	50±6	70±14	0.029±0.005	8090±1112	0.514±0.147	0.104±0.041	<BDL	0.075±0.019	9.2±1.4	121±24	20688±1323	0.064±0.008	7080±1284
22	700±119	0.039±0.008	72±22	78±13	0.027±0.006	7512±1043	0.097±0.009	<BDL	1.00±0.30	0.902±0.213	8.8±1.2	101±23	12474±1802	0.056±0.019	8620±1438
23	472±132	0.039±0.011	91±37	52±12	0.050±0.020	6317±1003	0.290±0.099	0.398±0.136	1.01±0.21	0.095±0.038	7.6±2.1	112±13	19502±1346	0.069±0.029	5274±917
24	520±80	0.046±0.009	58±4	87±27	0.014±0.003	6384±1486	0.247±0.079	0.407±0.200	<BDL	3.823±0.597	11.6±2.1	128±16	11088±2452	0.057±0.011	5148±1409
25	445±48	0.025±0.011	86±9	81±28	0.010±0.003	7924±1134	0.388±0.085	0.201±0.066	<BDL	1.418±0.494	9.2±1.5	91±18	14012±2829	0.054±0.023	8651±1743
26	516±67	0.034±0.005	61±9	69±7	0.048±0.008	9000±982	0.191±0.019	<BDL	<BDL	0.530±0.110	6.2±1.0	100±8	19007±1995	0.077±0.007	7790±833
27	393±43	0.054±0.010	36±11	52±33	0.022±0.003	6537±2120	0.844±0.492	<BDL	<BDL	0.125±0.018	10.9±1.9	138±63	27035±5181	0.089±0.016	6306±1936
28	607±125	0.055±0.022	56±7	53±13	0.026±0.017	8115±1382	0.432±0.087	<BDL	<BDL	0.912±0.125	13.5±1.3	112±26	21292±2941	0.096±0.035	3869±1199
29	572±82	0.037±0.012	50±11	95±19	0.108±0.074	7708±312	0.293±0.079	0.144±0.077	<BDL	0.150±0.026	10.4±1.2	153±21	23822±976	0.100±0.013	7113±967
30	539±91	0.028±0.010	53±13	58±13	0.010±0.002	9810±1205	0.225±0.043	0.164±0.044	<BDL	0.518±0.073	10.3±1.1	108±41	14522±1193	0.034±0.007	6285±1069

[a]1,2: União da Vitória; 3,4: Bituruna; 5, 8: São Mateus do Sul; 6,7: Mallet; 9, 10: São João do Triunfo; 11: Itaiópolis; 12, 13: Três Barras; 14: Canoinhas; 15: Vargem Bonita; 16: Catanduvas; 17: Lebon Regis; 18: Rebouças; 19: Guarapuava; 20: Prudentópolis; 21: Irati; 22: Imbituva; 23: Barrão de Cotegipe; 24: Erechim; 25: Getúlio Vargas; 26, 28: Ilópolis; 27: Putinga; 29: Anta Gorda; 30: Cruz Machado.

Table S4. Elemental composition of unwashed yerba mate leaf samples from 30 collection sites in three states in southern Brazil. Means and standard deviation of four samples (mg kg^{-1}). (continued)

Site	Mn	Mo	Na	Ni	P	Pb	Rb	S	Se	Sr	Ti	Tl	V	Zn
1	2316±827	0.051±0.019	<BDL	1.88±0.70	939±38	0.200±0.031	33±5.9	1559±51	<BDL	59±18.9	4.2±0.99	0.009±0.005	0.276±0.105	42±32
2	1640±541	<BDL	37±40	5.18±0.88	1032±103	<BDL	36±5.3	1575±115	<BDL	43±12.8	3.7±0.59	<BDL	0.194±0.036	17±4
3	5195±2156	0.053±0.052	<BDL	2.02±1.02	915±43	<BDL	32±9.5	1723±139	0.013±0.003	22±7.4	2.9±0.28	0.051±0.036	0.092±0.024	179±107
4	3093±696	0.166±0.010	<BDL	5.41±1.21	963±39	<BDL	31±3.9	1603±205	0.013±0.002	43±10	2.2±0.14	0.018±0.007	0.074±0.010	56±14
5	1285±190	0.213±0.060	<BDL	2.84±0.46	990±107	0.602±0.417	16±4.1	1925±58	0.078±0.054	42±6.6	3.8±0.40	0.027±0.006	0.270±0.075	16±4
6	4167±774	0.129±0.012	<BDL	3.17±1.61	1080±72	0.246±0.060	57±16.4	1804±88	0.044±0.051	34±8.5	3.5±0.37	0.024±0.012	0.300±0.053	95±31
7	2076±343	0.105±0.034	<BDL	4.55±2.01	887±73	0.222±0.171	66±8.7	1641±57	0.018±0.002	31±4.6	2.5±0.54	0.014±0.007	0.102±0.005	53±21
8	1240±174	0.125±0.032	<BDL	3.58±0.96	1084±62	0.247±0.139	44±7.3	1902±166	0.014±0.002	67±2.7	2.4±0.25	0.011±0.003	0.152±0.010	49±8
9	2130±194	0.138±0.013	<BDL	5.50±1.89	1146±269	0.429±0.293	35±10.6	1721±297	0.031±0.012	75±24.6	2.9±0.50	0.014±0.008	0.155±0.026	28±16
10	1365±224	0.095±0.018	<BDL	6.03±1.73	1496±193	0.253±0.159	70±10.2	2061±84	0.015±0.004	51±12.6	2.3±0.15	0.032±0.010	0.115±0.027	133±20
11	2766±416	0.107±0.019	41±20	4.54±1.32	818±92	<BDL	16±3.2	1817±158	0.021±0.002	23±5.6	2.8±0.45	<BDL	0.140±0.031	35±12
12	1977±801	0.081±0.020	<BDL	2.68±0.96	910±118	<BDL	124±34.2	1861±163	0.015±0.002	79±10.2	2.5±0.42	<BDL	0.077±0.013	40±15
13	3415±686	0.055±0.015	21±4	5.72±1.04	807±43	0.257±0.164	59±7.1	1665±105	0.027±0.003	48±7.3	3.2±0.36	0.009±0.006	0.135±0.022	35±9
14	4840±1163	0.102±0.027	<BDL	4.93±1.99	949±60	0.193±0.026	30±8.5	1850±39	0.024±0.002	25±3.8	3.1±0.26	0.011±0.003	0.165±0.021	27±12
15	2433±374	0.053±0.014	<BDL	4.25±0.97	1146±24	<BDL	28±7.6	1993±186	0.044±0.005	27±2.8	3.4±0.22	0.020±0.010	0.138±0.013	101±22
16	6115±877	0.053±0.025	<BDL	6.05±1.93	1082±98	0.411±0.150	34±13.1	1866±113	0.037±0.030	21±6.1	4.4±0.86	0.033±0.018	0.174±0.060	179±108
17	10044±1941	<BDL	<BDL	2.21±0.91	926±45	<BDL	32±13.1	1697±76	0.021±0.004	20±4.1	3.1±0.17	<BDL	0.138±0.020	50±19
18	2400±504	0.090±0.022	<BDL	5.34±1.04	862±48	0.600±0.263	29±1.7	1745±104	0.031±0.009	67±17.4	4.3±0.69	0.016±0.004	0.246±0.049	41±11
19	2572±299	<BDL	<BDL	6.36±1.47	1207±257	0.151±0.035	53±14.4	1870±64	0.019±0.005	27±1.5	2.6±0.08	0.010±0.007	0.121±0.036	51±4
20	2954±656	0.120±0.025	<BDL	3.27±0.96	1011±67	0.307±0.105	34±7.3	1939±148	0.025±0.002	87±15.9	3.4±0.24	0.010±0.005	0.193±0.005	64±21
21	2809±640	0.078±0.025	<BDL	2.70±0.45	879±38	0.450±0.244	43±5.1	1862±168	0.027±0.006	58±7.6	4.2±0.79	0.024±0.012	0.265±0.064	95±36
22	1700±226	0.118±0.009	<BDL	6.70±1.87	918±52	0.257±0.055	20±3.9	1742±158	0.036±0.004	66±10.8	3.4±0.69	0.017±0.005	0.208±0.065	39±10
23	3110±618	0.442±0.123	<BDL	1.47±0.55	2084±318	<BDL	14±2.8	1594±66	0.021±0.003	14±2.6	3.8±0.40	<BDL	0.288±0.025	136±84
24	3953±390	0.071±0.007	<BDL	6.37±2.51	1351±152	0.226±0.106	38±6.9	1990±31	0.028±0.003	33±8.0	4.1±0.64	0.053±0.053	0.326±0.062	51±22
25	5542±752	<BDL	<BDL	2.88±0.63	1169±46	0.192±0.129	36±5.6	2055±85	0.032±0.013	35±9.2	3.5±0.75	0.034±0.017	0.218±0.062	64±11
26	2250±389	0.093±0.036	104±33	0.49±0.11	997±116	0.358±0.037	74±10.4	1981±187	0.020±0.002	50±2.3	3.9±0.29	0.017±0.014	0.220±0.033	42±27
27	1136±434	0.108±0.028	42±8	1.11±0.57	942±30	0.328±0.034	104±38.8	1807±142	0.020±0.002	29±13.2	3.7±0.79	<BDL	0.205±0.014	57±37
28	3248±850	0.262±0.037	40±10	2.06±0.55	1416±212	0.364±0.048	119±26.6	1961±171	0.049±0.007	40±9.6	4.0±0.34	0.012±0.008	0.243±0.065	84±15
29	1995±648	0.168±0.062	27±5	2.18±0.65	891±24	0.480±0.117	71±25	1902±68	0.027±0.003	62±7.5	4.7±0.63	0.027±0.011	0.341±0.087	64±20
30	3896±857	<BDL	<BDL	3.55±1.34	977±71	0.221±0.115	30±2.5	1890±29	0.026±0.001	66±26.5	3.7±0.51	0.039±0.032	0.191±0.030	75±16

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Table S5. Soil chemical properties of soil from 30 sites with yerba mate collected from 30 collection sites in three states in southern Brazil (mg kg^{-1}).

Site	Ag	Al	As	Ba	Be	Ca	Cd	Co	Cr	Cs	Cu	Fe	K	Li	Mg	Mn	Mo	Na	Ni	P	Pb	Rb	Se	Sr	Tl	U	V	Zn
1	0.074	25495	4.0	18	0.291	59	0.021	2.5	11.0	1.3	17	25040	296	8	313	139	0.591	75	7	274	7	3.0	0.334	4.3	0.088	0.71	92	22
2	0.187	50713	7.6	102	0.571	166	0.077	7.2	31.8	1.4	77	61391	358	10	568	308	1.522	52	22	640	12	3.1	0.526	31.7	0.116	1.29	251	46
3	0.227	57406	6.3	56	1.020	472	0.137	153.8	60.1	1.0	236	152698	481	19	1252	1632	1.174	122	42	734	13	2.7	0.799	7.8	0.411	1.80	601	137
4	0.243	73970	16.6	43	0.434	70	0.102	10.4	66.4	3.3	158	117664	972	21	859	318	1.992	98	34	804	21	7.3	1.065	8.7	0.411	2.67	644	97
5	0.146	77992	35.6	48	0.771	242	0.051	3.9	56.1	5.5	40	50586	1097	53	720	163	2.902	74	23	531	24	10.9	0.819	10.8	0.337	3.53	164	63
6	0.160	74839	18.5	124	1.318	135	0.077	4.4	56.6	10.5	27	48969	4313	42	2975	256	2.831	154	18	432	28	58.8	0.909	14.8	0.584	4.11	103	50
7	0.143	64484	14.1	80	0.920	206	0.066	3.2	36.6	10.5	21	35822	4376	40	2568	98	1.474	150	11	462	21	63.0	0.749	8.8	0.532	3.72	87	49
8	0.141	59825	11.0	145	2.196	374	0.049	3.4	32.8	6.8	20	38980	4567	25	1591	120	0.985	138	11	584	23	53.9	0.593	62.0	0.455	4.01	77	40
9	0.059	33908	9.2	49	0.711	46	0.028	1.7	24.3	5.3	8	19841	2063	18	677	73	0.637	97	8	230	8	26.9	0.440	7.6	0.267	1.86	55	17
10	0.066	54378	13.8	35	0.593	35	0.024	1.9	28.7	3.9	9	28948	1079	16	397	56	0.971	93	9	279	10	10.4	0.440	5.8	0.189	2.49	76	16
11	0.087	26394	2.4	156	0.688	511	0.041	2.0	18.0	6.0	5	11195	7665	16	2142	147	0.256	503	5	157	12	80.2	0.304	17.3	0.392	2.12	37	23
12	0.182	86039	40.7	71	0.980	349	0.064	5.0	65.4	10.2	39	62449	1633	67	993	247	2.850	81	24	504	30	19.8	0.780	13.4	0.429	3.99	188	75
13	0.154	55352	6.8	168	1.312	209	0.091	6.3	31.5	8.1	16	30388	6429	26	2621	723	0.632	226	11	387	26	88.9	0.393	17.1	0.509	3.13	73	54
14	0.151	77708	12.9	131	1.554	213	0.043	2.9	36.1	10.5	22	38923	6458	40	3519	170	1.171	146	12	383	25	74.6	0.650	17.2	0.449	4.03	93	41
15	0.183	64819	14.0	83	0.995	743	0.12	67.5	91.1	2.7	231	131988	1032	24	1026	902	1.502	127	64	829	17	6.5	0.998	9.6	0.391	1.67	665	133
16	0.183	58946	11.3	55	0.709	194	0.088	44.3	102.8	3.0	188	136841	1143	21	1266	1336	1.445	325	50	783	16	9.2	0.808	6.1	0.371	1.77	604	133
17	0.268	57374	9.2	91	0.662	217	0.117	15.4	33.4	5.5	155	108884	1355	12	1232	778	1.495	166	21	988	19	26.6	0.908	20.9	0.379	2.81	452	96
18	0.168	65055	14.9	198	2.108	319	0.058	6.5	54.6	13.4	32	52634	8466	33	2845	224	1.201	189	16	531	29	94.0	0.860	26.1	0.852	3.78	142	60
19	0.193	73266	11.7	36	0.647	85	0.087	14.0	48.0	2.6	159	112460	791	18	818	556	1.747	92	45	746	17	6.6	1.045	7.7	0.321	2.21	562	92
20	0.119	53020	11.3	114	1.198	192	0.061	3.1	31.9	9.4	18	27363	4572	34	1850	124	0.969	162	11	399	20	53.7	0.527	15.4	0.453	2.81	80	50
21	0.154	57833	10.3	172	1.370	234	0.078	5.3	34.4	8.8	21	35008	6595	44	3543	372	1.062	182	15	472	25	79.9	0.529	18.9	0.698	4.04	83	45
22	0.093	58967	28.7	25	0.578	49	0.039	3.2	47.6	3.7	21	40310	622	37	351	143	1.861	31	19	335	15	5.7	0.491	5.0	0.196	2.43	128	35
23	0.234	69565	10.5	94	1.544	1384	0.233	55.4	27.5	2.1	240	157456	1453	23	1736	2391	1.683	157	41	2389	19	9.7	0.806	13.9	0.511	2.46	749	235
24	0.216	76492	17.8	57	1.195	173	0.084	21.0	41.1	5.5	194	143890	1166	25	1222	1046	1.927	93	30	900	25	10.1	0.680	9.8	0.460	2.78	688	129
25	0.219	74277	20.7	52	0.877	170	0.097	14.4	49.3	5.9	165	137528	1310	34	1066	850	1.979	86	27	648	24	10.2	0.815	9.9	0.506	2.82	600	117
26	0.165	48812	8.1	317	1.678	1023	0.151	4.6	7.4	11.2	15	35737	14585	49	1927	433	1.312	4577	4	697	29	115.1	0.676	33.7	0.601	3.11	49	84
27	0.209	49084	11.9	262	1.945	1282	0.253	9.4	13.9	10.2	20	38832	4831	66	1693	1279	1.711	889	5	685	32	68.8	0.524	28.9	0.619	4.32	54	110
28	0.205	43762	9.4	294	1.295	1272	0.186	8.3	7.5	9.9	20	37425	12244	43	1348	1404	1.531	3959	4	725	27	96.3	0.657	31.5	0.672	2.94	37	101
29	0.216	61814	7.3	250	1.273	1352	0.285	30.2	11.0	8.4	60	66646	4361	24	2305	2123	1.310	694	6	506	33	64.2	0.532	34.4	1.235	4.64	150	151
30	0.275	73671	12.7	64	0.597	364	0.134	19.5	33.1	3.2	181	127060	926	22	1369	766	2.190	135	44	1224	19	8.0	1.065	21.9	0.307	2.21	615	112

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