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APPENDICES

APPENDIX A

APPARATUS AND MATERIALS

Table A-1 Apparatus and Materials used in this study

Apparatus	Model	Series Number
1. PNP Orbital Shaker	OS-3	PNP062/48
2. Sartorius Balance 4 digits ,Germany	TE 214S	SWB:17508312
3. Thermolyne Hot Plate stirrer 7x7 inches, USA	SPA-1020B	1138040375412
4. Varian Inductively Coupled Plasma Optical Emission Spectrometry (ICP-OES), Australia	VISTA-MPX Axial	EL 02086289
5. Kendro Centrifuge, Germany	Biofuge Statos	40163872
6. Binder Oven, Germany	400(E2)	00-182047
7. Milestone Microwave Digestion and Extraction System, Italy	ETHOS PRO	127547
8. Milestone Microwave Digestion and Extraction System, Italy	ETHOS SEL	125060
9. Thermo Forma Freezer, USA	925	803075-2586
10. Orto alresa Sieve shaker and sieve 200 mesh, 0.075 mm or 75 um, Spain	TA002	542-54/03
11. ELGA Water purification system (15 M Ω), England	OR 007BPM1	OR07F 181595BP
12. ELGA Water purification system (18 M Ω), England	Option R7 Maxima HPLC	OR07F 181595BP

APPENDIX B

SAMPLING SITES

Table B-1 The description of sampling sites studied in this research

Sampling sites number	Concentration Zoning	Location
M(1-3)	Red (> 20 mg/kg)	Phatad-phadeang District
M(4-8)	Orange (3-20 mg/kg)	Phatad-phadeang District
M(9-12)	Orange (3-20 mg/kg)	Phatad-phadeang District
M(13-15)	Orange (3-20 mg/kg)	Mae Tao District
M(16-18)	Orange (3-20 mg/kg)	Mae Ku District
M(19-21)	Yellow (< 3 mg/kg)	Mae Ku District
M(22-24)	Orange (3-20 mg/kg)	Mae Tao District
J(25-30)	Red (> 20 mg/kg)	Phatad-phadeang District
J(31-33)	Red (> 20 mg/kg)	Mae Tao District
J(34-39)	Red (> 20 mg/kg)	Mae Ku District
J(40-45)	Orange (3-20 mg/kg)	Mae Tao District
J(46-51)	Yellow (< 3 mg/kg)	Mae Ku District
O(51-57)	Red (> 20 mg/kg)	Phatad-phadeang District
O(58-60)	Red (> 20 mg/kg)	Mae Tao District
O(61-66)	Red (> 20 mg/kg)	Mae Ku District
O(67-72)	Orange (3-20 mg/kg)	Mae Tao District
O(73-78)	Yellow (< 3 mg/kg)	Mae Ku District
O(79-81)	Yellow (< 3 mg/kg)	Mae Ku

APPENDIX C

PREPARATION OF REAGENT SOLUTION FOR BCR SEQUENTIAL EXTRACTION

C-1 Exchangeable fraction (BCR1): 0.11 molL⁻¹ acetic acid solution

Add in a fume cupboard, 25 ± 0.2 ml of glacial acetic acid to about 0.5 L of distilled water in a 1 L graduated polypropylene or polyethylene bottle and make up to volume with distilled water. Take 250 ml of this solution (acetic acid, 0.43 molL⁻¹) and dilute to 1 L with distilled water to obtain an acetic acid solution of 0.11 molL⁻¹

C-2 Reducible fraction (BCR2): 0.5 molL⁻¹ hydroxylamine hydrochloride solution

Dissolve 34.75 g of hydroxylammonium chloride in 400 ml of distilled water. Transfer the solution into a 1 L calibrated flask and add, by means of a calibrated pipette, 25 ml of 2 molL⁻¹ HNO₃ (prepared by weighing from a suitable concentrated solution). Make up to volume with distilled water. Prepare this solution on the same day the extraction is carried out. The hydroxylammonium chloride was prepared prior to use.

APPENDIX D

MICROWAVE DIGESTION

D-1 Soil and Root Digestion (EPA 3052)

This method is provided for the acid digestion of EPA 3052 in a closed vessel service using temperature control microwave heating for the metal determination by spectroscopic methods. The microwave used was Milestone ETHOS PRO and SEL model lab station with HPR-1000/10S high pressure segmented rotor

Sample: 0.5 g.

Reagent: 10 mL of HNO₃ (65%), 3 mL HF and 15 mL HBO₃

Procedure:

1. Place a Tetrafluoro methoxil (TFM) vessel on the balance plate, tare it and weight 0.5 gram of sample.
2. Introduce the THM vessel into the HTC safety shield
3. First, add 10 mL of HNO₃ (65%) and 3 mL of HF then gently swirl the solution to homogenize the sample with the acid
4. Close the vessel and introduce it into the rotor segment, then tighten by using the torque wrench.
5. Insert the segment into the microwave cavity and connect the temperature sensor.
6. Run the microwave program to completion, as presented in Table D-1.
7. Cool the rotor by air and by water until the solution reaches room temperature.
8. Open the vessel
9. Add 15 mL of HBO₃ and repeat step 3-8 and transfer the solution to a marked flask.

Table D-1 Microwave program for soil digestion

Step	Time	Temperature	Microwave Power
1	8 minutes	160 °C	Up to 1000 watt
2	7 minutes	160 °C	Up to 1000 watt

D-2 Leaves, Top, Bagasse, and Underground stem Digestion

This method is described for the acid digestion of a Grass sample in a closed vessel microwave sample preparation work station. The microwave used was Milestone ETHOS PRO and SEL model lab station with HPR-1000/10S high pressure segmented rotor

Sample: 0.75 g.

Reagent: 12 mL of HNO₃ (65%), 3 mL of H₂O₂

Procedure:

1. Place a Tetrafluoro methoxil (TFM) vessel on the balance plate, tare it and weight 0.75 gram of sample.
2. Introduce the THM vessel into the HTC safety shield
3. Add the acids then gently swirl the solution to homogenize the sample with the acid.
4. Close the vessel and introduce it into the rotor segment, then tighten by using the torque wrench.
5. Insert the segment into the microwave cavity and connect the temperature sensor.
6. Run the microwave program to completion, as presented in Table D-2.
7. Cool the rotor by air and by water until the solution reaches room temperature.
8. Open the vessel and transfer the solution to a marked flask.

Table D-2 Microwave program for leave, top, bagasse, and underground stem digestion

Step	Time	Temperature	Microwave Power
1	3 minutes	85 °C	Up to 1000 watt
2	9 minutes	145 °C	Up to 1000 watt
3	4 minutes	200 °C	Up to 1000 watt
4	14 minutes	200 °C	Up to 1000 watt

APPENDIX E

PHYSICOCHEMICAL CHARACTERISTICS OF STUDIED SOILS

Table E-1 Physicochemical characteristics of studied soils

Sampling Sites	pH	OM (%)	ORP (mV)
M-1	7.75	3.57	207.7
M-2	7.80	2.55	206.3
M-3	7.75	3.21	201.0
M-4	7.08	2.67	276.6
M-5	7.71	1.78	240.4
M-6	7.79	2.13	223.2
M-7	7.90	2.30	216.5
M-8	7.77	3.26	243.5
M-9	8.07	2.67	192.1
M-10	7.84	2.50	219.5
M-11	7.78	2.99	200.7
M-12	7.89	2.82	215.1
M-13	7.29	0.52	252.5
M-14	7.42	0.67	234.5
M-15	7.96	2.55	188.8
M-16	7.35	2.38	17.0
M-17	7.60	1.83	250
M-18	7.35	1.14	265
M-19	6.65	2.28	264.9
M-20	7.50	2.17	238.8
M-21	7.58	2.82	247.9
M-22	6.42	1.28	287.9
M-23	7.10	0.99	265.3
M-24	7.19	1.19	347.9
J-25	6.87	1.23	202.3

Sampling Sites	pH	OM (%)	ORP (mV)
J-26	6.93	1.63	156.7
J-27	5.79	1.23	330.1
J-28	6.60	1.70	167.7
J-29	7.01	1.90	115.5
J-30	7.09	1.33	-91.6
J-31	7.49	2.08	105.7
J-32	7.61	1.51	132.6
J-33	7.73	2.30	88.0
J-34	7.45	3.32	249.3
J-35	7.27	2.48	104.1
J-36	7.43	3.64	-119.9
J-37	7.78	3.78	74.5
J-38	7.46	3.68	-189.9
J-39	7.40	3.56	-157.4
J-40	6.95	0.79	62.1
J-41	6.52	0.57	98.2
J-42	7.33	1.90	-74.2
J-43	6.95	0.55	75.7
J-44	6.99	1.58	108.0
J-45	7.33	2.05	-111.8
J-46	7.57	3.63	94.05
J-47	7.67	3.51	246.4
J-48	7.88	3.47	247.5
J-49	7.51	3.74	-31.7
J-50	7.54	3.68	6.9
J-51	7.79	3.91	68.2
O-52	6.68	1.48	283.7
O-53	6.25	1.56	308.9
O-54	7.22	2.47	289.5
O-55	6.25	2.79	233.7
O-56	6.75	2.10	185.4
O-57	7.16	0.91	242.2

Sampling Sites	pH	OM (%)	ORP (mV)
O-58	7.13	2.27	229
O-59	6.96	2.80	228.5
O-60	7.27	2.32	241.5
O-61	6.52	3.39	-142.9
O-62	6.61	4.16	-215.5
O-63	6.86	3.36	-120.7
O-64	6.90	3.59	-291.1
O-65	7.34	2.22	-158.7
O-66	7.19	4.06	-256
O-67	7.40	0.60	191.9
O-68	7.04	1.56	4.0
O-69	6.64	1.22	186.4
O-70	6.63	1.31	-48.9
O-71	7.06	1.29	90.9
O-72	7.34	2.25	-129.3
O-73	7.62	3.99	138.3
O-74	7.62	3.78	169.5
O-75	7.52	3.93	177.5
O-76	7.48	3.02	182.0
O-77	7.23	3.02	192.2
O-78	7.41	3.42	197.9

APPENDIX F

TOTAL METAL CONCENTRATIONS

Table F-1 Total metal concentrations (Cd, Cu, Fe, Mn, Pb and Zn) in 81 soil samples

Samples (Soil)	Metals concentrations in soil samples (mg/kg)					
	Cd	Cu	Fe	Mn	Pb	Zn
M-1	26.28	24.36	16152	735.3	82.17	1766
M-2	13.36	26.79	16099	1022	43.61	609.8
M-3	7.94	21.61	15460	465.1	40.31	621.5
M-4	2.41	15.35	14170	469.7	23.34	142.8
M-5	2.58	16.27	16048	787.0	26.77	151.0
M-6	4.78	22.05	15926	1222	29.33	295.7
M-7	3.61	19.45	14767	791.6	27.63	229.8
M-8	4.89	19.33	15722	531.8	32.54	302.5
M-9	9.17	20.86	15453	770.0	34.28	492.7
M-10	6.14	25.18	16621	1163	30.10	335.2
M-11	11.61	24.77	15926	1093	32.71	444.5
M-12	14.46	16.90	13934	596	37.32	630.7
M-13	1.08	17.40	10059	416.6	9.78	54.75
M-14	1.23	8.74	5551	166.4	10.26	57.10
M-15	42.86	18.58	13430	487.3	76.37	1882
M-16	1.44	19.17	13469	144.9	22.28	40.40
M-17	1.62	22.63	14911	182.5	23.74	26.11
M-18	1.92	22.25	17159	217.3	24.89	29.03
M-19	1.34	17.31	11062	536.3	14.78	63.89
M-20	2.03	23.84	14706	717.2	20.37	109.6
M-21	1.72	20.63	13263	609.1	17.63	85.91
M-22	2.39	10.85	7482	445.5	17.14	232.7
M-23	2.66	9.66	7982	195.9	17.69	312.4
M-24	2.96	13.51	10534	224.7	15.18	175.3
J-25	no sample	no sample	no sample	no sample	no sample	no sample
J-26	2.86	23.68	15935	392.1	20.57	150.9
J-27	1.80	23.44	14608	338.6	16.71	101.8
J-28	2.29	27.50	16446	528.5	22.76	146.4
J-29	2.91	22.05	14322	361.2	21.34	155.0
J-30	2.09	22.15	13927	240.4	17.52	103.1
J-31	117.9	23.22	15597	1042	8.76	2544
J-32	157.3	22.39	15150	1044	139.7	3138
J-33	172.7	22.14	14948	1049	160.2	3123
J-34	3.42	26.22	17216	606.4	80.14	159.5
J-35	1.89	17.90	13710	438.2	15.45	76.51
J-36	2.90	24.01	15707	561.0	21.61	132.4
J-37	6.62	26.72	17783	1007	25.11	329.7
J-38	3.17	21.52	15185	512.0	19.31	151.7

Samples (Soil)	Metals concentrations in soil samples (mg/kg)					
	Cd	Cu	Fe	Mn	Pb	Zn
J-39	3.49	24.27	16611	567.1	21.67	165.0
J-40	1.41	8.45	5414	170.5	10.83	82.52
J-41	0.8819	9.19	6145	617.8	8.31	3138
J-42	4.77	15.12	9667	356.1	21.40	3123
J-43	2.40	8.59	5563	109.8	9.39	140.9
J-44	5.94	13.73	8997	327.3	21.00	397.1
J-45	4.90	17.60	11341	348.6	24.58	413.1
J-46	7.00	25.54	17952	622.6	25.03	464.8
J-47	5.20	25.64	17963	536.6	23.76	365.1
J-48	9.57	24.87	17540	689.1	25.12	522.6
J-49	3.47	23.71	17129	554.4	21.95	278.7
J-50	4.92	23.15	16433	456.3	23.20	371.6
J-51	6.41	25.49	17834	507.6	25.20	458.7
O-52	1.29	12.18	9576	269.8	12.88	71.75
O-53	1.55	11.81	10492	292.4	13.27	82.46
O-54	2.72	12.63	10642	237.3	17.94	132.7
O-55	3.19	14.98	12328	819.1	21.08	177.6
O-56	1.72	12.38	9852	433.2	14.24	88.35
O-57	0.7347	6.35	5646	83.37	6.39	28.53
O-58	125.4	12.97	12243	1019	138.4	2629
O-59	133.4	12.11	10571	741.3	113.2	2488
O-60	170.1	12.22	10964	929.4	147	2666
O-61	1.83	15.85	12526	269.5	18.50	73.54
O-62	2.03	14.41	11966	263.8	18.22	85.12
O-63	1.43	12.39	11983	370.5	16.68	42.14
O-64	2.38	13.39	12055	294.7	18.09	113.5
O-65	1.46	11.31	11753	787.1	16.10	48.76
O-66	2.11	14.85	11857	282.2	18.41	102.0
O-67	0.98	5.25	3526	115.5	7.83	40.73
O-68	2.83	7.26	5203	162.9	13.61	177.8
O-69	1.29	7.63	5994	216.7	9.45	57.44
O-70	2.50	4.99	3437	65.27	9.55	119.3
O-71	2.61	7.33	5201	187.2	12.60	153.9
O-72	3.91	10.76	7972	237.0	21.07	277.3
O-73	6.19	15.62	13625	491.3	22.70	337.7
O-74	4.70	15.47	13475	439.7	21.67	246.6
O-75	8.92	14.59	12548	517.6	23.66	438.3
O-76	3.54	14.16	12572	439.5	20.41	195.6
O-77	4.89	12.56	11524	274.3	19.92	270.5
O-78	4.24	14.26	12513	362.6	20.06	215.6
O-79	1.46	13.59	11646	328.0	13.41	53.20
O-80	1.46	14.48	10206	367.6	12.12	42.93
O-81	1.38	12.92	11221	348.6	12.79	49.99

APPENDIX G

METAL CONCENTRATION IN SUGARCANE

Table G-1 Cadmium (Cd) determination in 81 sugarcane samples (root, bagasse and juice)

Samples	Cadmium (Cd) concentration in sugarcane samples (mg/kg)		
	Root	Bagasse	Juice
M-1	6.09	1.37	2.11
M-2	5.15	1.10	1.66
M-3	8.18	1.49	2.00
M-4	0.94	0.7380	2.20
M-5	1.45	0.8390	3.17
M-6	3.49	0.9882	2.00
M-7	2.13	0.8607	2.53
M-8	3.60	0.9926	2.23
M-9	3.83	0.9323	1.35
M-10	2.40	0.8252	1.59
M-11	1.76	0.8718	1.731
M-12	6.23	1.57	2.85
M-13	0.85	0.5517	6.57
M-14	11.16	1.13	5.72
M-15	11.25	1.70	3.68
M-16	no sample	0.6808	2.18
M-17	no sample	0.6458	1.40
M-18	no sample	0.7332	1.86
M-19	0.6343	0.6219	2.75
M-20	1.03	0.7422	1.46
M-21	0.9000	0.6743	2.09
M-22	3.34	1.19	2.85
M-23	1.93	1.19	3.28
M-24	3.08	1.02	2.77
J-25	no sample	no sample	5.19
J-26	1.01	0.5460	5.83
J-27	0.6230	0.3989	13.79
J-28	0.6264	0.3971	28.21
J-29	2.03	0.4544	5.08
J-30	2.09	0.4243	5.20
J-31	17.69	2.10	8.51
J-32	15.28	0.9559	6.34
J-33	25.25	no sample	7.39
J-34	1.58	0.4052	6.47
J-35	1.56	0.3659	11.99
J-36	1.36	0.3921	9.09

Samples	Cadmium (Cd) concentration in sugarcane samples (mg/kg)		
	Root	Bagasse	Juice
J-37	5.56	0.3488	8.66
J-38	3.01	0.9069	13.60
J-39	1.72	0.2494	7.49
J-40	4.37	1.01	9.66
J-41	2.48	0.7283	6.02
J-42	4.32	0.5457	10.41
J-43	3.09	0.9996	8.77
J-44	1.85	0.9687	8.92
J-45	1.82	0.6771	10.56
J-46	1.92	0.4416	5.20
J-47	4.38	0.4973	6.22
J-48	3.69	0.4349	7.48
J-49	2.52	0.4355	6.64
J-50	1.91	0.5606	8.98
J-51	2.70	0.4855	6.18
O-52	2.04	0.1195	9.74
O-53	1.14	0.1353	5.55
O-54	1.61	0.2162	15.62
O-55	2.32	0.0771	32.93
O-56	0.76	0.0808	14.69
O-57	1.51	0.0242	7.75
O-58	13.38	2.2774	9.72
O-59	14.66	0.6497	10.85
O-60	21.17	2.2610	4.02
O-61	1.22	0.0047	14.04
O-62	1.11	0.0219	7.82
O-63	1.06	0.0131	9.39
O-64	0.6568	0.0222	11.52
O-65	1.53	0.0089	7.00
O-66	1.32	0.0000	10.37
O-67	2.69	no sample	11.92
O-68	7.41	0.4161	8.02
O-69	2.47	0.3213	5.75
O-70	4.19	0.7450	13.67
O-71	13.22	0.3525	9.83
O-72	7.05	0.0948	11.64
O-73	2.02	0.1041	5.58
O-74	2.87	0.1430	3.73
O-75	2.48	0.1105	2.89
O-76	1.14	0.0853	5.31
O-77	1.76	0.1695	3.72
O-78	1.86	0.0907	4.30
O-79	0.4069	0.0514	0.0091
O-80	0.6169	0.0470	0.0063
O-81	0.4172	0.0526	0.0051

Table G-2 Copper (Cu) determination in 81 sugarcane samples (root, bagasse and juice)

Samples	Copper (Cu) concentration in sugarcane samples (mg/kg)		
	Root	Bagasse	Juice
M-1	5.96	3.95	0.3045
M-2	6.65	4.14	0.2413
M-3	9.93	3.33	0.2609
M-4	5.33	2.88	0.1873
M-5	6.32	4.14	0.2693
M-6	10.92	3.73	0.2876
M-7	7.52	3.77	0.2299
M-8	6.13	4.05	0.2444
M-9	5.81	2.96	0.1963
M-10	7.42	3.35	0.2755
M-11	10.82	3.72	0.2220
M-12	6.45	3.94	0.2777
M-13	8.27	4.27	0.6816
M-14	34.87	2.29	0.2865
M-15	6.08	3.32	0.4297
M-16	no sample	3.65	0.3201
M-17	no sample	3.95	0.2811
M-18	no sample	3.55	0.2602
M-19	6.05	2.81	0.2467
M-20	7.91	3.63	0.1855
M-21	6.91	3.83	0.2626
M-22	6.28	4.48	0.3897
M-23	6.79	3.97	0.3981
M-24	6.47	4.21	0.4840
J-25	no sample	no sample	0.1918
J-26	7.67	4.03	0.2182
J-27	7.28	3.61	0.2468
J-28	7.16	6.39	0.2935
J-29	7.61	4.67	0.2243
J-30	6.71	4.55	0.2623
J-31	4.10	3.90	0.2036
J-32	4.57	2.67	0.1624
J-33	4.98	no sample	0.1733
J-34	6.31	1.90	0.0353
J-35	6.50	2.53	0.0687
J-36	5.02	2.00	0.0365
J-37	8.64	1.62	0.0464
J-38	7.59	7.32	0.1250
J-39	5.79	1.01	0.0841
J-40	6.87	4.53	0.4487
J-41	5.74	4.46	0.2742
J-42	5.12	4.03	0.3660

Samples	Copper (Cu) concentration in sugarcane samples (mg/kg)		
	Root	Bagasse	Juice
J-43	8.38	3.54	0.3485
J-44	8.86	3.91	0.3356
J-45	14.07	4.42	0.2584
J-46	11.94	4.24	0.3459
J-47	6.31	3.95	0.3264
J-48	5.41	4.25	0.2857
J-49	3.11	3.60	0.3471
J-50	7.37	4.74	0.4063
J-51	10.92	3.73	0.2414
O-52	6.93	86.04	0.1235
O-53	5.58	12.76	0.0782
O-54	5.62	9.94	0.1261
O-55	8.21	8.55	0.1510
O-56	3.90	5.36	0.0874
O-57	5.80	4.99	0.0946
O-58	2.56	3.08	0.0811
O-59	3.23	2.58	0.0600
O-60	2.98	2.89	0.0740
O-61	3.00	3.61	0.0532
O-62	2.67	3.54	0.1079
O-63	6.60	6.23	0.1008
O-64	1.86	3.62	0.0238
O-65	5.37	2.81	0.0232
O-66	2.64	2.71	0.0225
O-67	2.63	no sample	0.1748
O-68	3.80	4.42	0.1012
O-69	2.74	3.70	0.0758
O-70	3.34	2.96	0.0933
O-71	3.78	3.08	0.0906
O-72	2.48	2.18	0.0568
O-73	5.50	3.00	0.1042
O-74	6.62	2.76	0.0911
O-75	5.96	2.53	0.0781
O-76	4.87	4.14	0.1054
O-77	6.32	3.79	0.1394
O-78	4.50	3.49	0.1163
O-79	4.57	2.90	0.2847
O-80	5.84	2.19	0.1824
O-81	5.93	1.92	0.1665

Table G-3 Iron (Fe) determination in 81 sugarcane samples (root, bagasse and juice)

Samples	Iron (Fe) concentration in sugarcane samples (mg/kg)		
	Root	Bagasse	Juice
M-1	1382	102	2.11
M-2	1330	108	1.66
M-3	3474	112	2.00
M-4	1102	112	2.20
M-5	1109	248	3.17
M-6	752	103	2.00
M-7	807	110	2.53
M-8	1413	118	2.23
M-9	1711	116	1.35
M-10	1234	106	1.59
M-11	2204	108	1.73
M-12	999	342	2.85
M-13	2091	137	6.57
M-14	18470	79.76	5.72
M-15	1008	61.80	3.68
M-16	no sample	85.01	2.18
M-17	no sample	89.36	1.40
M-18	no sample	70.16	1.86
M-19	2241	286	2.75
M-20	3490	108	1.46
M-21	2713	110	2.09
M-22	1550	60.38	2.85
M-23	477	50.28	3.28
M-24	1264	37.42	2.77
J-25	no sample	no sample	5.19
J-26	3473	132	5.83
J-27	2394	196	13.79
J-28	3694	148	28.21
J-29	2177	136	5.08
J-30	2305	148	5.20
J-31	2919	139	8.51
J-32	1368	118	6.34
J-33	2888	no sample	7.39
J-34	6856	119	6.47
J-35	4692	133	11.99
J-36	5458	142	9.09
J-37	6507	104	8.66
J-38	5059	118	13.60
J-39	4329	67.85	7.49
J-40	2569	140	9.66
J-41	1682	141	6.02
J-42	2323	214	10.41
J-43	2123	162	8.77

Samples	Iron (Fe) concentration in sugarcane samples (mg/kg)		
	Root	Bagasse	Juice
J-44	1735	138	8.92
J-45	2554	176	10.56
J-46	2104	122	5.20
J-47	5459	125	6.22
J-48	3169	127	7.48
J-49	1835	109	6.64
J-50	1976	143	8.98
J-51	2090	93.00	6.18
O-52	2438	59.00	9.74
O-53	3955	86.38	5.55
O-54	1459	79.36	15.62
O-55	1544	96.24	32.93
O-56	712	64.85	14.69
O-57	6645	58.86	7.75
O-58	1951	45.06	9.72
O-59	2225	63.94	10.85
O-60	1844	45.03	4.02
O-61	4604	73.01	14.04
O-62	3277	65.56	7.82
O-63	3115	53.31	9.39
O-64	3250	71.39	11.52
O-65	4759	48.95	7.00
O-66	4876	75.25	10.37
O-67	5807	no sample	11.92
O-68	5346	99.30	8.02
O-69	2560	75.56	5.75
O-70	5977	122	13.67
O-71	9478	101	9.83
O-72	5977	87.06	11.64
O-73	2130	55.59	5.58
O-74	4703	61.66	3.73
O-75	1589	47.72	2.89
O-76	1701	61.96	5.31
O-77	1153	45.79	3.72
O-78	1126	63.85	4.30
O-79	933	44.29	3.65
O-80	795	33.67	2.55
O-81	1511	37.44	3.04

Table G-4 Manganese (Mn) determination in 81 sugarcane samples (root, bagasse and juice)

Samples	Manganese (Mn) concentration in sugarcane samples (mg/kg)		
	Root	Bagasse	Juice
M-1	43.13	10.85	1.47
M-2	43.10	13.01	1.99
M-3	82.50	10.46	1.34
M-4	37.72	10.92	1.57
M-5	33.40	16.54	1.69
M-6	17.56	4.85	0.4689
M-7	20.14	6.96	0.7086
M-8	29.26	7.34	0.8027
M-9	36.38	6.03	0.6233
M-10	45.75	4.89	0.4063
M-11	72.81	5.74	0.5248
M-12	25.58	9.13	0.3499
M-13	44.90	32.95	8.27
M-14	67.84	48.91	11.69
M-15	39.74	21.98	4.38
M-16	no sample	14.27	2.40
M-17	no sample	10.68	1.83
M-18	no sample	20.24	3.45
M-19	90.34	13.25	1.52
M-20	108	4.77	0.2965
M-21	66.04	4.52	0.4160
M-22	52.97	11.16	1.82
M-23	46.25	20.77	4.09
M-24	27.30	52.83	11.72
J-25	no sample	no sample	1.69
J-26	83.97	16.47	1.58
J-27	55.62	18.42	1.79
J-28	54.53	15.55	1.03
J-29	108	17.39	1.46
J-30	86.50	21.97	2.64
J-31	214	9.29	0.9374
J-32	115	6.72	0.5378
J-33	144	no sample	0.4640
J-34	320	22.43	3.75
J-35	2524	24.68	5.30
J-36	2083	25.48	2.83
J-37	788	18.78	2.34
J-38	297	29.82	5.07
J-39	288	25.38	4.07
J-40	86.53	24.31	3.40
J-41	78.17	19.23	2.40

Samples	Manganese (Mn) concentration in sugarcane samples (mg/kg)		
	Root	Bagasse	Juice
J-42	81.41	17.91	2.00
J-43	60.55	23.31	4.18
J-44	55.97	17.30	2.51
J-45	71.24	21.59	3.29
J-46	59.83	6.53	0.9654
J-47	71.67	3.57	0.3568
J-48	81.79	4.02	0.2994
J-49	152	7.65	0.8638
J-50	77.69	12.37	1.26
J-51	64.81	7.56	0.5497
O-52	106.67	19.32	0.5422
O-53	67.67	7.02	0.1839
O-54	28.33	10.07	0.4735
O-55	62.55	17.15	0.9189
O-56	28.99	18.91	0.4679
O-57	119	40.53	1.36
O-58	121	20.66	0.7350
O-59	139	20.07	0.7792
O-60	120	11.78	0.3798
O-61	158	54.04	2.43
O-62	103	52.90	3.15
O-63	1900	47.90	2.54
O-64	298	46.55	2.26
O-65	1334	46.42	2.23
O-66	250	44.14	2.42
O-67	91.41	no sample	2.41
O-68	128.24	38.32	1.59
O-69	63.35	41.74	1.32
O-70	80.42	49.87	2.45
O-71	134	31.52	1.74
O-72	179	33.29	2.39
O-73	75.82	10.53	0.3551
O-74	115	7.08	0.1622
O-75	50.96	9.27	0.2974
O-76	44.00	7.61	0.2272
O-77	26.76	6.33	0.1743
O-78	30.72	5.91	0.16
O-79	22.14	9.60	1.46
O-80	25.93	12.84	1.71
O-81	71.18	11.80	1.46

Table G-5 Lead (Pb) determination in 81 sugarcane samples (root, bagasse and juice)

Samples	Lead (Pb) concentration in sugarcane samples (mg/kg)		
	Root	Bagasse	Juice
M-1	4.94	2.79	0.00 nd
M-2	4.53	4.63	0.0155
M-3	8.06	3.74	0.0136
M-4	1.98	3.16	0.0072
M-5	1.52	3.64	0.0102
M-6	2.23	3.02	0.0116
M-7	3.62	7.39	0.0121
M-8	1.54	3.41	0.0150
M-9	3.83	2.90	0.0146
M-10	3.55	3.65	0.00 nd
M-11	3.33	2.50	0.0097
M-12	2.22	3.01	0.0174
M-13	4.77	0.6683	0.00 nd
M-14	4.37	2.24	0.0135
M-15	3.22	1.73	0.0094
M-16	no sample	2.50	0.0062
M-17	no sample	6.60	0.00 nd
M-18	no sample	1.47	0.00 nd
M-19	1.92	3.10	0.0111
M-20	4.92	2.94	0.0096
M-21	4.51	4.02	0.00 nd
M-22	3.05	0.00 nd	0.0117
M-23	0.6860	0.00 nd	0.00 nd
M-24	4.07	0.00 nd	0.00 nd
J-25	no sample	no sample	0.0205
J-26	4.13	1.61	0.0214
J-27	2.34	1.41	0.0211
J-28	3.41	1.26	0.0329
J-29	0.9533	2.41	0.0157
J-30	3.22	3.02	0.0203
J-31	11.56	2.21	0.0333
J-32	4.53	1.33	0.0151
J-33	11.60	no sample	0.0131
J-34	2.38	1.28	0.0330
J-35	1.94	3.67	0.0154
J-36	2.12	1.84	0.0162
J-37	4.08	0.8791	0.0183
J-38	1.96	0.00 nd	0.0146
J-39	3.23	0.00 nd	0.0243
J-40	2.49	2.82	0.0086
J-41	1.16	3.57	0.0387
J-42	2.62	0.8128	0.0171
J-43	1.05	2.60	0.0156

Samples	Lead (Pb) concentration in sugarcane samples (mg/kg)		
	Root	Bagasse	Juice
J-44	1.87	1.50	0.0482
J-45	6.61	2.15	0.0087
J-46	0.9398	0.6608	0.0390
J-47	4.50	1.60	0.0236
J-48	3.38	1.29	0.0546
J-49	1.04	0.8544	0.0112
J-50	0.7284	0.8412	0.0183
J-51	1.40	no sample	0.0122
O-52	3.83	1.20	0.0012
O-53	4.33	0.8905	0.0050
O-54	2.07	0.7757	0.0039
O-55	2.50	0.5616	0.0051
O-56	0.6733	0.5336	0.00 nd
O-57	4.39	0.2408	0.0037
O-58	13.31	0.0000	0.0082
O-59	11.13	0.0576	0.00 nd
O-60	12.73	0.0966	0.0056
O-61	2.18	0.2696	0.0024
O-62	1.57	0.2370	0.0102
O-63	2.33	0.3014	0.0049
O-64	0.8448	0.2226	0.00 nd
O-65	3.91	0.0000	0.00 nd
O-66	1.42	0.2783	0.00 nd
O-67	4.65	no sample	0.00 nd
O-68	8.24	0.00 nd	0.0053
O-69	2.74	0.00 nd	0.0014
O-70	6.63	0.00 nd	0.0079
O-71	11.27	0.00 nd	0.00 nd
O-72	9.13	0.00 nd	0.0049
O-73	2.24	0.00 nd	0.00 nd
O-74	5.31	0.00 nd	0.00 nd
O-75	1.76	0.00 nd	0.0041
O-76	1.72	0.00 nd	0.0050
O-77	1.12	0.00 nd	0.0055
O-78	1.31	0.00 nd	0.0054
O-79	0.6277	0.00 nd	1.08
O-80	1.01	0.00 nd	1.12
O-81	1.19	0.13	1.10

Note: 0.00nd = not-detected

Table G-6 Zinc (Zn) determination in 81 sugarcane samples (root, bagasse and juice)

Samples	Zinc (Zn) concentration in sugarcane samples (mg/kg)		
	Root	Bagasse	Juice
M-1	104	30.78	7.02
M-2	93.98	28.17	4.83
M-3	207	26.53	5.02
M-4	30.86	15.06	2.65
M-5	26.78	30.15	3.55
M-6	49.79	22.55	3.79
M-7	42.08	21.37	3.15
M-8	60.22	24.90	4.64
M-9	82.33	17.81	2.77
M-10	38.52	16.28	2.79
M-11	39.61	20.64	2.33
M-12	88.30	31.84	9.63
M-13	37.58	27.51	15.62
M-14	363	28.64	14.83
M-15	130	38.99	14.00
M-16	no sample	11.00	2.59
M-17	no sample	11.25	1.43
M-18	no sample	10.00	2.16
M-19	21.52	10.23	1.98
M-20	27.50	12.67	1.44
M-21	24.53	14.13	2.73
M-22	131	81.07	29.81
M-23	63.39	63.79	20.48
M-24	112	43.53	15.57
J-25	no sample	no sample	1.57
J-26	35.84	17.47	2.29
J-27	29.62	13.49	1.77
J-28	33.71	31.58	2.42
J-29	29.02	20.97	1.78
J-30	27.23	21.65	2.39
J-31	271	114.05	14.93
J-32	262	37.90	6.84
J-33	401	no sample	11.20
J-34	37.08	5.83	1.13
J-35	47.20	9.15	1.88
J-36	42.69	8.87	1.06
J-37	108	8.47	1.84
J-38	48.95	45.89	2.24
J-39	38.40	5.93	1.87
J-40	121	47.77	8.66
J-41	61.39	31.84	4.55
J-42	83.44	21.96	4.29
J-43	59.59	46.86	10.74

Samples	Zinc (Zn) concentration in sugarcane samples (mg/kg)		
	Root	Bagasse	Juice
J-44	68.16	36.54	7.32
J-45	14.07	4.42	3.775
J-46	11.94	4.24	3.13
J-47	6.31	3.95	3.46
J-48	5.41	4.25	2.88
J-49	3.11	3.60	2.83
J-50	7.37	4.74	3.91
J-51	10.92	3.73	2.48
O-52	6.93	86.04	0.8392
O-53	5.58	12.76	0.5022
O-54	5.62	9.94	1.10
O-55	8.21	8.55	1.29
O-56	3.90	5.36	0.7905
O-57	5.80	4.99	0.8314
O-58	2.56	3.08	6.95
O-59	3.23	2.58	3.41
O-60	2.98	2.89	9.42
O-61	3.00	3.61	0.9176
O-62	2.67	3.54	1.10
O-63	6.60	6.23	1.37
O-64	1.86	3.62	0.5512
O-65	5.37	2.81	0.7316
O-66	2.64	2.71	0.51
O-67	2.63	no sample	4.38
O-68	3.80	4.42	2.99
O-69	2.74	3.70	2.35
O-70	3.34	2.96	5.39
O-71	3.78	3.08	2.58
O-72	2.48	2.18	1.43
O-73	5.50	3.00	1.07
O-74	6.62	2.76	1.08
O-75	5.96	2.53	1.25
O-76	4.87	4.14	1.20
O-77	6.32	3.79	1.31
O-78	4.50	3.49	1.12
O-79	4.57	2.90	2.40
O-80	5.84	2.19	1.87
O-81	5.93	1.92	1.56

Table G-7 Cadmium (Cd) determination for the end crop (1ER-52 to 1ER-81) sugarcane samples (top, leaves and underground stem)

Samples	Cadmium (Cd) in sugarcane samples (mg/kg)		
	Top	Leaves	Underground Stem
O-52	0.1105	0.3485	0.1596
O-53	0.0456	0.3148	0.1127
O-54	0.5597	0.3060	0.2160
O-55	0.1968	0.2196	0.2297
O-56	0.0481	0.2393	0.0663
O-57	0.0000	0.1594	0.0729
O-58	0.7422	1.08	2.63
O-59	0.2491	0.3252	1.59
O-60	1.97	0.9815	3.72
O-61	0.0014	0.0541	0.0485
O-62	0.0138	0.0520	0.0655
O-63	0.0090	0.0796	0.0075
O-64	0.0013	0.0721	0.0071
O-65	0.0000	0.0858	0.0953
O-66	0.0023	0.0774	0.0102
O-67	0.5313	0.1809	0.3242
O-68	0.5610	0.3743	0.5864
O-69	0.5728	0.3816	0.4519
O-70	0.1097	0.2199	1.38
O-71	0.5417	0.2710	0.7218
O-72	0.3138	0.2487	0.2811
O-73	0.0494	0.1953	0.0919
O-74	0.0644	0.5480	0.1002
O-75	0.0732	0.2734	0.1440
O-76	0.1455	0.1111	0.1718
O-77	0.0684	0.1766	0.3142
O-78	0.0451	0.2133	0.2249
O-79	0.0586	0.2055	0.0891
O-80	0.0340	0.1872	0.0484
O-81	0.0735	0.1453	0.0734

Table G-8 Copper (Cu) determination for the end crop (1ER-52 to 1ER-81) sugarcane samples (top, leaves and underground stem)

Samples	Copper (Cu) in sugarcane samples (mg/kg)		
	Top	Leaves	Underground Stem
O-52	8.08	3.26	2.08
O-53	7.21	3.15	1.92
O-54	10.21	4.39	3.88
O-55	8.09	2.42	2.08
O-56	7.12	2.80	1.80
O-57	5.52	2.16	1.45
O-58	6.90	2.91	1.43
O-59	4.61	2.57	1.37
O-60	8.37	3.05	1.58
O-61	4.18	1.85	1.05
O-62	7.03	2.07	1.04
O-63	6.19	1.72	1.16
O-64	2.41	1.03	0.63
O-65	1.99	1.36	2.33
O-66	1.35	1.25	0.61
O-67	10.80	2.10	2.26
O-68	11.81	3.01	2.85
O-69	9.95	2.41	1.58
O-70	5.56	2.31	1.54
O-71	8.64	2.67	2.94
O-72	5.83	1.97	1.53
O-73	7.72	3.34	1.22
O-74	6.76	3.14	1.26
O-75	6.83	2.69	2.03
O-76	9.79	3.22	5.47
O-77	8.19	2.86	4.30
O-78	8.39	2.96	3.17
O-79	4.72	2.60	5.79
O-80	3.22	2.40	1.96
O-81	4.54	2.21	2.17

Table G-9 Iron (Fe) determination for the end crop (1ER-52 to 1ER-81) sugarcane samples (top, leaves and underground stem)

Samples	Iron (Fe) in sugarcane samples (mg/kg)		
	Top	Leaves	Underground Stem
O-52	66.35	602	125
O-53	492	485	111
O-54	85.98	643	51.63
O-55	87.29	579	76.51
O-56	81.60	417	226
O-57	71.49	373	111
O-58	86.64	223	119
O-59	94.96	271	82.77
O-60	79.25	149	379
O-61	100	133	277
O-62	150	89.71	177
O-63	150	107	200
O-64	60.82	147	151
O-65	54.83	277	172
O-66	112	248	616
O-67	116	236	363
O-68	103	348	304
O-69	80.23	394	546
O-70	90.04	229	613
O-71	118	225	595
O-72	72.00	505	143
O-73	58.00	649	131
O-74	61.29	425	105
O-75	112	233	335
O-76	70.68	350	166
O-77	107	554	325
O-78	78.38	148	152
O-79	65.88	172	160
O-80	76.91	118	109
O-81	5.93	1.92	0.1705

Table G-10 Manganese (Mn) determination for the end crop (1ER-52 to 1ER-81) sugarcane samples (top, leaves and underground stem)

Samples	Manganese (Mn) in sugarcane samples (mg/kg)		
	Top	Leaves	Underground Stem
O-52	69.94	94.54	10.55
O-53	66.71	70.77	6.67
O-54	89.36	68.30	7.54
O-55	43.74	63.17	13.86
O-56	71.25	78.52	11.81
O-57	102	123	14.53
O-58	82.39	157	11.18
O-59	78.06	75.32	12.93
O-60	84.32	101	9.79
O-61	182	201	26.09
O-62	283	230	22.04
O-63	196	148	58.89
O-64	168	165	25.33
O-65	141	205	19.76
O-66	121	206	21.93
O-67	159	207	24.97
O-68	166	165	21.66
O-69	180	149	26.70
O-70	173	128	32.43
O-71	168	121	30.60
O-72	233	161	53.94
O-73	51.62	113	8.48
O-74	36.51	78.29	6.98
O-75	59.56	125	7.55
O-76	59.25	78.69	9.89
O-77	39.13	66.06	6.30
O-78	29.37	59.22	9.77
O-79	63.40	48.13	8.96
O-80	71.34	71.21	11.03
O-81	36.28	54.22	11.94

Table G-11 Lead (Pb) determination for the end crop (1ER-52 to 1ER-81) sugarcane samples (top, leaves and underground stem)

Samples	Lead (Pb) in sugarcane samples (mg/kg)		
	Top	Leaves	Underground Stem
O-52	0.3828	1.53	0.00 nd
O-53	0.1850	1.25	0.00 nd
O-54	1.01	1.07	0.00 nd
O-55	0.3334	1.73	0.00 nd
O-56	0.1367	1.51	0.00 nd
O-57	0.0000	1.17	0.00 nd
O-58	0.8308	1.70	0.00 nd
O-59	0.00 nd	1.35	0.00 nd
O-60	0.00 nd	1.51	0.00 nd
O-61	0.00 nd	0.7564	0.00 nd
O-62	0.00 nd	0.6256	0.00 nd
O-63	0.00 nd	1.14	0.00 nd
O-64	0.00 nd	0.4718	0.00 nd
O-65	0.00 nd	1.01	0.00 nd
O-66	0.00 nd	0.7089	0.00 nd
O-67	0.00 nd	1.04	0.00 nd
O-68	0.00 nd	1.36	0.00 nd
O-69	0.00 nd	1.42	0.00 nd
O-70	0.00 nd	0.8495	0.00 nd
O-71	0.00 nd	0.8632	0.00 nd
O-72	0.00 nd	0.9812	0.00 nd
O-73	0.00 nd	0.9934	0.00 nd
O-74	0.00 nd	1.23	0.00 nd
O-75	0.00 nd	0.6742	0.00 nd
O-76	0.00 nd	0.4437	0.00 nd
O-77	0.00 nd	0.5995	0.00 nd
O-78	0.00 nd	1.13	0.00 nd
O-79	0.00 nd	0.5025	0.2106
O-80	0.00 nd	0.4366	0.3804
O-81	0.2629	0.2668	0.2860

Note: 0.00nd = not-detected

Table G-12 Zinc (Zn) determination for the end crop (1ER-52 to 1ER-81) sugarcane samples (top, leaves and underground stem)

Samples	Zinc (Zn) in sugarcane samples (mg/kg)		
	Top	Leaves	Underground Stem
O-52	59.35	43.99	1.91
O-53	85.41	42.65	1.52
O-54	103	44.98	2.02
O-55	66.12	34.88	7.72
O-56	66.08	33.02	2.03
O-57	36.89	24.75	1.42
O-58	159	130	28.01
O-59	122	91.47	57.05
O-60	266	130	79.65
O-61	33.97	18.85	0.3995
O-62	41.98	18.48	0.5591
O-63	40.13	18.16	1.28
O-64	20.97	13.78	0.0490
O-65	13.41	17.29	0.9133
O-66	14.40	18.91	0.00 nd
O-67	143	41.10	22.78
O-68	159	63.59	67.25
O-69	166	53.23	22.45
O-70	126	73.66	101.74
O-71	124	52.28	79.60
O-72	94.32	39.44	20.60
O-73	45.45	33.43	3.93
O-74	36.34	30.25	1.68
O-75	40.69	29.87	8.71
O-76	54.07	24.75	14.73
O-77	44.62	31.02	11.76
O-78	46.62	38.17	10.45
O-79	51.49	19.69	8.74
O-80	26.70	20.09	9.49
O-81	30.00	16.36	9.29

Note: 0.00nd = not-detected

APPENDIX H

THE FIRST-TWO STEP BCR SEQUENTIAL EXTRACTION

Table H-1 Metal concentration by the first step of BCR sequential extraction (BCR1)

Samples (Soil)	Metals concentration by BCR1 (mg/kg)					
	Cd	Cu	Fe	Mn	Pb	Zn
M-1	7.03	0.1394	4.01	136	0.5118	130
M-2	3.92	0.2195	4.96	419	0.2814	46.19
M-3	1.55	0.1079	3.85	93.28	0.2710	37.55
M-4	0.2752	0.1335	3.42	134	0.1377	11.01
M-5	0.2871	0.1292	2.22	154	0.1375	8.43
M-6	0.8017	0.1345	2.07	129	0.1131	16.42
M-7	0.5585	0.1270	2.56	127	0.1308	20.82
M-8	0.8768	0.1426	4.32	98.82	0.1458	31.08
M-9	2.20	0.1203	22.09	105	0.1393	44.64
M-10	1.17	0.1855	2.23	148	0.0940	25.34
M-11	2.64	0.3349	9.20	162	0.0465	39.55
M-12	3.93	0.1351	2.59	90.03	0.2474	64.90
M-13	0.0513	0.1868	3.36	52.96	0.1212	1.74
M-14	0.0456	0.1901	2.82	73.49	0.3006	1.09
M-15	18.73	0.1636	6.89	104	1.0348	288
M-16	0.0660	0.1826	21.18	31.85	0.2725	2.94
M-17	0.0237	0.0780	2.88	44.29	0.1780	1.11
M-18	0.0214	0.0733	1.64	42.36	0.2655	1.00
M-19	0.0662	0.1367	6.24	142.40	0.1353	4.14
M-20	0.1166	0.1556	4.12	97.78	0.0000	2.83
M-21	0.0672	0.1126	3.36	94.46	0.0935	2.89
M-22	0.9868	0.1851	6.21	91.53	0.2917	40.03
M-23	0.9926	0.1140	3.74	54.93	0.1522	22.78
M-24	0.9944	0.1656	8.74	70.57	0.3681	61.57
J-25	0.1068	0.0000	1.92	24.01	0.5930	2.50
J-26	0.0979	0.0560	1.82	23.14	0.4938	2.27
J-27	0.0638	0.1374	1.25	21.08	0.4638	1.10
J-28	0.0562	0.0778	1.69	39.58	0.5597	1.90
J-29	0.1699	0.1416	6.14	36.85	0.3360	4.32
J-30	0.0770	0.1384	3.31	15.54	0.5826	1.72
J-31	5.60	0.1632	5.45	82.57	1.01	148
J-32	6.67	0.1843	5.42	75.42	0.9217	194
J-33	9.13	0.1003	5.48	86.80	1.17	184
J-34	0.1109	0.1961	2.53	55.96	0.5226	2.77
J-35	0.0566	0.0779	6.14	38.81	0.4709	1.41
J-36	0.0902	0.0392	4.09	53.43	0.4247	2.65

Samples (Soil)	Metals concentration by BCR1 (mg/kg)					
	Cd	Cu	Fe	Mn	Pb	Zn
J-37	0.4530	0.1454	6.20	217	0.3488	9.59
J-38	0.2128	0.0906	44.29	105	0.6092	6.58
J-39	0.1616	0.1733	35.66	78.27	0.6963	5.45
J-40	0.1319	0.1558	4.49	16.77	0.6907	3.04
J-41	0.0433	0.1463	0.0926	0.3508	0.8277	0.00 nd
J-42	0.0508	0.00 nd	0.1159	0.4427	0.7519	0.9094
J-43	0.0572	0.0903	0.1891	0.1920	0.6171	0.8042
J-44	0.0535	0.0240	0.1280	0.3822	0.5262	1.42
J-45	0.0468	0.00 nd	0.1627	0.2674	0.6599	0.46
J-46	0.0384	0.0219	0.1653	0.2484	0.4413	0.3179
J-47	0.0344	0.00 nd	0.0602	0.3551	0.4785	0.0162
J-48	0.0522	0.00 nd	0.1141	0.4455	0.6073	1.00
J-49	0.0609	0.00 nd	0.2327	0.1934	0.4733	0.8733
J-50	0.6145	0.0975	0.1446	0.4366	0.4882	1.75
J-51	0.0499	0.0243	0.0927	0.3934	0.3233	1.03
O-52	0.4015	0.2771	7.47	159	1.27	19.11
O-53	0.4631	0.2813	9.83	215	1.35	24.23
O-54	0.8591	0.2725	21.77	139	0.5969	43.39
O-55	1.08	0.3067	24.36	340	1.14	60.86
O-56	0.4013	0.2454	16.85	241	1.14	19.44
O-57	0.1424	0.2120	9.55	85.14	0.7070	5.79
O-58	88.53	0.3356	41.63	291	3.68	2384
O-59	69.88	0.3101	28.39	311	4.88	2641
O-60	100	0.5045	21.40	458	6.13	2570
O-61	0.3787	0.3442	0.3442	344	1.12	25.63
O-62	0.5421	0.3454	0.3454	345	1.23	37.19
O-63	0.2145	0.2763	0.2763	331	1.76	12.47
O-64	0.8376	0.3049	0.3049	339	1.50	55.99
O-65	0.2436	0.2693	0.2693	635	1.27	15.77
O-66	0.6535	0.3029	0.3029	348	1.73	46.07
O-67	0.6492	0.3662	18.20	115	0.8146	28.83
O-68	1.29	0.2458	29.80	92.70	0.4470	59.19
O-69	0.2725	0.1502	3.76	78.06	0.2788	14.26
O-70	1.04	0.2486	18.94	124	0.8023	54.52
O-71	1.57	0.2743	41.91	55.82	0.4265	60.09
O-72	0.8644	0.1489	7.60	77.70	0.4361	37.00
O-73	2.80	0.3591	15.23	298	1.15	104
O-74	1.91	0.2399	16.51	209	1.25	72.56
O-75	4.53	0.2141	11.59	247	1.04	160
O-76	0.9894	0.2764	12.46	173	1.13	40.57
O-77	2.91	0.3218	12.44	218	1.31	143
O-78	1.90	0.2734	14.59	185	1.45	74.17
O-79	0.1229	0.6465	73.98	305	0.3149	0.3149
O-80	0.0987	0.5324	87.920	285	0.00 nd	0.00 nd
O-81	0.0740	0.4069	28.03	258	0.2895	0.2895

Note: 0.00nd = not-detected

Table H-2 Metal concentration by the second step of BCR sequential extraction (BCR2)

Samples (Soil)	Metals concentration by BCR2 (mg/kg)					
	Cd	Cu	Fe	Mn	Pb	Zn
M-1	17.20	1.70	1140	360	48.69	947
M-2	7.66	2.47	1369	377	25.65	374
M-3	4.89	1.51	873	207	21.74	343
M-4	0.7098	1.83	1490	172	11.11	39.48
M-5	0.4776	1.48	844	354	12.09	24.18
M-6	2.15	2.73	1464	810	15.73	126
M-7	1.44	1.84	1188	412	12.92	82.35
M-8	2.27	1.89	1627	235	15.17	120
M-9	4.88	1.54	905	391	16.34	250
M-10	2.74	1.88	948	685	14.08	149
M-11	6.62	1.77	1137	653	17.63	240
M-12	8.44	1.53	1241	314	22.07	364
M-13	0.0659	1.08	343	228	4.52	5.01
M-14	0.0394	1.25	443	12.33	5.00	3.62
M-15	23.08	1.32	1543	204	48.52	1006
M-16	0.0847	1.26	1154	21.22	9.74	5.54
M-17	0.0416	0.9494	324	37.51	10.59	3.33
M-18	0.0249	1.01	246	74.34	12.01	1.45
M-19	0.1958	1.25	953	201	5.90	8.97
M-20	0.3535	1.96	771	397	9.13	12.34
M-21	0.1869	1.58	990	294	6.91	12.56
M-22	0.6581	1.35	897	227	8.82	74.60
M-23	0.7947	1.26	697	57.49	9.99	112
M-24	0.8077	1.12	512	87.74	7.04	57.28
J-25	1.08	1.30	1190	185	10.39	39.68
J-26	0.9067	1.20	852	184	9.95	35.18
J-27	0.3811	1.331	685	152	7.94	11.59
J-28	0.4802	1.29	783	258	8.82	22.40
J-29	1.01	1.09	1161	127	8.14	38.73
J-30	0.5313	0.9020	955	72.19	7.00	15.33
J-31	20.81	0.2193	155	151	9.70	318
J-32	19.13	0.1639	115	121	9.47	341
J-33	24.22	0.1451	133	145	11.77	349
J-34	1.5068	0.9029	1523	289	10.43	53.09
J-35	0.4661	0.5686	563	148	6.05	16.78
J-36	0.1143	0.1628	40.42	5.54	1.03	4.43
J-37	0.1603	0.2445	28.01	5.20	0.9091	10.95
J-38	0.0886	0.0841	17.48	1.30	0.8143	2.98
J-39	0.0742	0.1518	12.79	1.00	0.5969	2.24
J-40	0.1711	0.1940	119	8.18	1.51	7.28
J-41	0.0953	0.1893	55.58	61.79	1.32	2.88
J-42	1.36	0.4104	318	57.48	5.73	98.48

Samples (Soil)	Soil Extraction (mg/kg)					
	Cd	Cu	Fe	Mn	Pb	Zn
J-43	0.2035	0.1588	73.87	1.85	1.30	13.60
J-44	0.8516	0.3364	285	25.06	3.35	57.94
J-45	1.60	0.5752	569	66.79	8.04	107
J-46	0.0978	0.1466	45.58	2.27	1.03	4.21
J-47	0.2503	0.5539	369	454	4.53	10.43
J-48	2.75	0.7800	790	142	12.55	185
J-49	1.01	0.5711	693	21.37	6.01	52.33
J-50	2.79	0.7113	1243	98.53	11.53	161
J-51	2.47	0.8748	890	99.99	12.51	160
O-52	0.7778	1.31	18.20	360	22.68	49.41
O-53	0.5062	0.6641	343	58.19	8.19	17.34
O-54	1.05	0.6118	423	47.39	10.73	66.87
O-55	1.02	0.6686	392	156	9.16	69.73
O-56	0.5743	0.5610	270	59.10	7.12	22.37
O-57	0.0545	0.8284	378	31.02	3.41	2.69
O-58	91	0.7775	1172	986	49.11	1443
O-59	90	0.6348	980	701	46.06	1398
O-60	114	0.6575	1063	862	52.32	1339
O-61	0.4087	1.56	2467	no sample	11.04	24.62
O-62	0.6287	1.41	2661	148	10.35	33.87
O-63	0.1504	1.00	1389	300	9.98	12.95
O-64	0.9634	1.42	2020	170	11.61	56.16
O-65	0.2388	1.14	1409	645	10.33	16.26
O-66	0.7877	1.41	2053	177	12.58	50.48
O-67	0.2806	0.5663	804	73.53	3.99	21.33
O-68	1.33	0.9855	1736	96.95	9.85	142
O-69	0.4746	0.8501	890	174	6.05	34.65
O-70	1.19	0.7798	1590	30.03	7.27	103
O-71	1.88	0.8232	1432	175	9.59	172
O-72	2.82	1.35	1964	182	16.70	283
O-73	4.07	1.00	2042	441	14.52	288
O-74	3.26	0.9498	1881	415	13.29	189
O-75	8.13	0.8962	1815	523	16.15	410
O-76	2.27	1.26	1938	447	12.97	136
O-77	3.22	1.27	1966	223	13.03	202
O-78	2.85	1.35	2690	369	14.06	169
O-79	0.6711	4.53	5066	539	28.10	36.27
O-80	0.6837	5.32	5266	865	27.29	33.78
O-81	0.6690	5.21	4464	789	28.00	33.84

APPENDIX I

STATISTICAL STUDIES

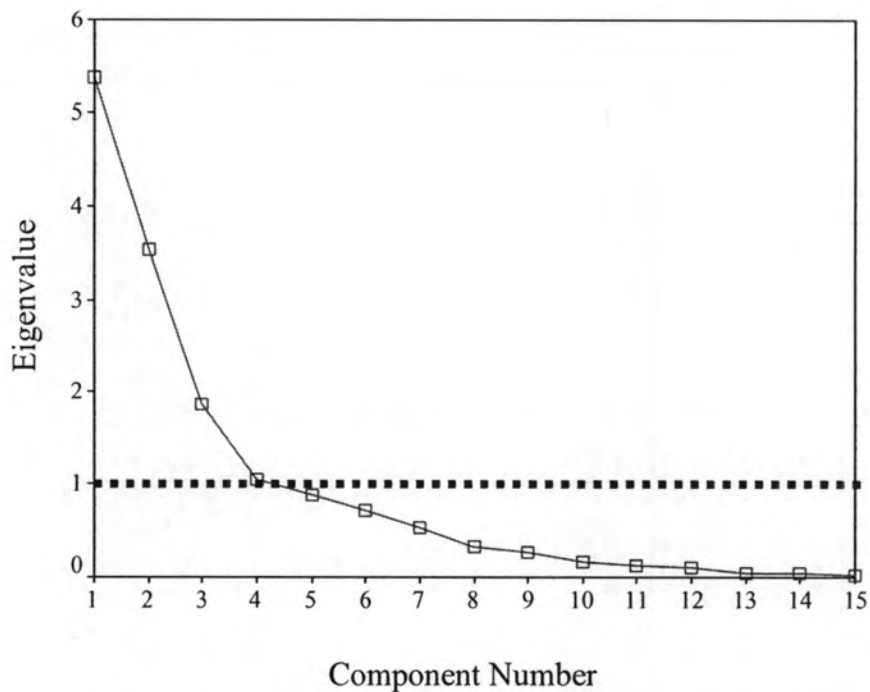


Figure I-1 Scree plot of principal component analysis (PCA)

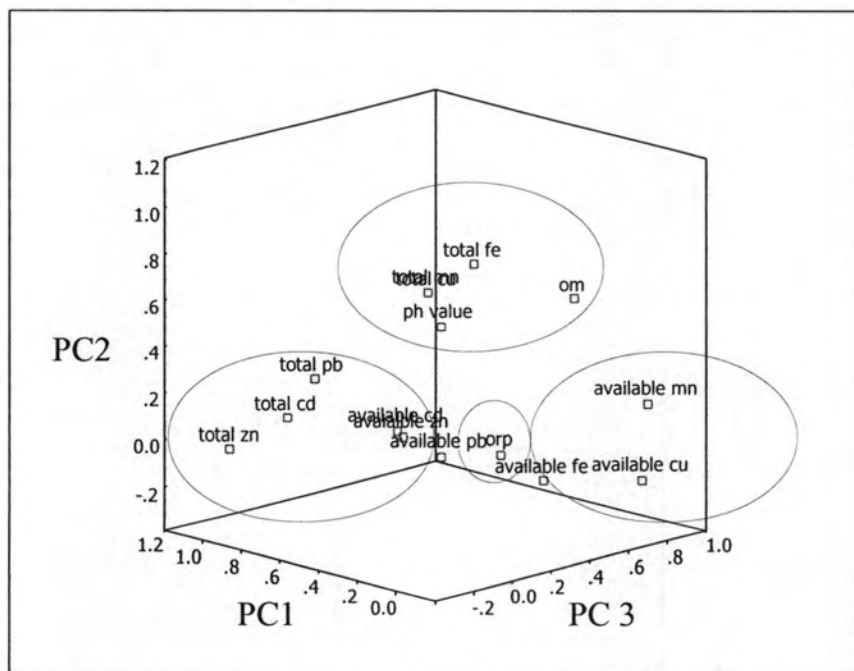


Figure I-2 Component plot in rotated space

Table I-1 Total variance explained

Component	Initial Eigenvalues			Extraction Sums of Squared Loadings			Rotation
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %	Total
1	5.368	35.788	35.788	5.368	35.788	35.788	4.882
2	3.553	23.688	59.476	3.553	23.688	59.476	3.403
3	1.866	12.440	71.916	1.866	12.440	71.916	3.382
4	1.035	6.897	78.813	1.035	6.897	78.813	1.449
5	.871	5.807	84.621				
6	.705	4.698	89.318				
7	.530	3.533	92.852				
8	.322	2.149	95.001				
9	.268	1.786	96.787				
10	.163	1.087	97.875				
11	.117	.777	98.652				
12	.107	.714	99.366				
13	.046	.309	99.675				
14	.034	.227	99.902				
15	.015	.098	100.000				

Extraction Method: Principal Component Analysis.

Table I-2 Component matrix of the data

	Component			
	1	2	3	4
Available Cd	.928	-.079	-.080	.046
Available Zn	.919	-.110	-.066	.041
Available Pb	.883	-.259	.159	-.113
Total Cd	.860	.192	-.278	-.172
Total Pb	.830	.323	-.206	-.080
Total Zn	.692	.226	-.401	-.351
Available Fe	.429	-.315	.145	.204
Total Cu	-.101	.916	.067	.050
Total Fe	.008	.909	.244	.109
pH value	.052	.686	.040	.105
Total Mn	.477	.668	.036	.203
Available Cu	.524	-.529	.447	.277
OM	.114	.510	.732	-.096
Available Mn	.501	-.220	.677	.160
ORP	.096	.075	-.518	.799

Extraction Method: Principal Component Analysis.

Table I-3 KMO and Bartlett's Test for PCA**KMO and Bartlett's Test**

Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		.731
Bartlett's Test of Sphericity	Approx. Chi-Square	1181.000
	df	105
	Sig.	.000

Table I-4 Normality test of the data

	All variables																				
	pH	OM	ORP	Cd ^a	Cu ^a	Fe ^a	Mn ^a	Pb ^a	Zn ^a	Cd ^b	Cu ^b	Fe ^b	Mn ^b	Pb ^b	Zn ^b	Cd ^c	Cu ^c	Fe ^c	Mn ^c	Pb ^c	Zn ^c
N	78	78	78	81	81	81	81	81	81	80	80	80	80	80	80	30	30	30	30	29	30
Kolmogorov-Smirnov Z	.844	.790	1.62	3.61	.995	2.23	1.45	1.86	3.68	3.76	1.06	.77	.94	2.96	2.99	1.47	1.44	0.86	1.55	.887	1.33
Asymp. Sig. (2-tailed)	0.48	.561	.011	0.00	.275	.000	.030	.002	.000	.000	.212	.598	.344	.000	.000	.027	.032	.449	.016	.425	.059

a = available (BCR1); b = total metals in soil; c = total metals in sugarcane

BIOGRAPHY

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Presentation:

Pensiri Akkajit and Chantra Tongcumpou. *Effects of other metals on cadmium uptake to sugarcane*. 1st The Proceedings of Pure and Applied Chemistry International Conference (PACCON) 2008, Bangkok, Thailand, January 30 - February 1, 2008. Organized by Kasetsart University, Chemical Society of Thailand, and The Thailand Research Fund