



**WAGENINGEN EVALUATING PROGRAMS
FOR ANALYTICAL LABORATORIES**

Certificate of Analysis



International Soil-Analytical Exchange

REFERENCE MATERIAL

ISE sample 938



General Information

In this report an overview is given of analytical data for this sample collected in our proficiency testing program. The consensus values are calculated using a robust statistical model. With this NDA model mean and standard deviation are calculated using all reported data when at least 8 results are left after removal of reported 'lower than' (<) and 0 (= zero) values. No outliers are removed.

This report is divided into three sections: Consensus Values, Indicative Values and Values for Information. The division is made on the reliability of the data. Consensus Values are based on at least 16 results while the coefficient of variation is smaller than 25 %. Indicative Values are based on at least 8 and less than 16 results or a coefficient of variation between 25 % and 50 %. Other values, based on more than 2 and less than 8 results or a coefficient of variation higher than 50 %, are given for information only.

In the sections with Consensus Values and Indicative Values the following parameters are given: mean, standard deviation, coefficient of variation, number of results, median and MAD (Median of Absolute Deviation) and the uncertainty in the consensus values. The confidence limits (at 95 % probability) are calculated for these determinands.

In the section with Information Values the following parameters are given: median, MAD and number of results. For determinands which have at least 5 results reported as smaller than (<) the median of these 'smaller than results' is calculated. In some cases this median of '<' values is much smaller than median and mean of the indicative values. This may be caused by a too optimistic (too low) value for the detection limit reported by a (small) majority of participating laboratories who report '<'-values.

All values, expressed on a weight basis (kg or %), are reported in oven dry (105 °C) material. Moisture is reported in the material as received.

Sample information

WEPAL reference materials are from natural sources only. There is no spiking, mixing or other alterations of the samples. For sample preparation the ISE samples are dried at 40 °C and milled to pass a 0.5 mm sieve.

This ISE sample 938 of Andosol from Nicaragua is prepared for the WEPAL proficiency programs. The sample is used in 2 periods (or rounds). The results on which the values in this report are based were taken from the periods given in the following table.

Year	Round	Number
1995	4	1
1994	1	1



Consensus Values ISE 938



Method: Real totals

Element	Unit	Mean	Std.Dev.	CV %	N	Median	MAD	Uncertainty	95 % confidence limits		
Al	g/kg	94.4	2.48	2.6	19	94.1	1.80	0.71	93.2	-	95.6
Ca	g/kg	38.9	3.07	7.9	24	38.0	2.38	0.78	37.6	-	40.2
Cu	mg/kg	221	36.3	16.4	26	217	26.8	8.9	207	-	236
Fe	g/kg	100	6.2	6.2	24	99.4	4.6	1.6	97.8	-	103.0
Mg	mg/kg	13000	3160	24.3	24	13900	1980	810	11670	-	14330
Mn	mg/kg	1830	274	15.0	25	1860	190	69	1712	-	1938
Na	mg/kg	9490	1535	16.2	22	9560	1101	409	8810	-	10170
P	mg/kg	1370	158	11.5	21	1350	103	43	1302	-	1445
Zn	mg/kg	119	23.7	19.9	27	118	17.0	5.7	110	-	129

Method: Acid extractable (So-called totals)

Element	Unit	Mean	Std.Dev.	CV %	N	Median	MAD	Uncertainty	95 % confidence limits		
Al	g/kg	64.0	6.13	9.6	80	63.3	4.35	0.86	62.6	-	65.3
Ba	mg/kg	487	47.9	9.8	54	482	33.5	8.1	474	-	500
Ca	g/kg	16.9	3.61	21.3	117	16.4	2.50	0.42	16.3	-	17.6
Co	mg/kg	32.7	5.12	15.6	90	33.0	3.55	0.68	31.7	-	33.8
Cu	mg/kg	189	14.4	7.6	179	189	10.0	1.3	186.4	-	190.6
Fe	g/kg	77.7	8.90	11.5	128	76.7	6.25	0.98	76.1	-	79.2
K	mg/kg	2190	235	10.7	99	2190	167	30	2145	-	2239
Mg	mg/kg	6910	1015	14.7	120	6830	704	116	6730	-	7097
Mn	mg/kg	1410	117	8.3	129	1400	80	13	1388	-	1429
N	g/kg	2.05	0.175	8.6	108	2.06	0.125	0.021	2.02	-	2.08
Ni	mg/kg	12.0	2.60	21.6	146	12.0	1.85	0.27	11.6	-	12.5
P	mg/kg	967	168.7	17.5	107	984	120.9	20.4	934	-	999
S	mg/kg	327	35.1	10.7	32	329	25.7	7.7	315	-	340
Sr	mg/kg	132	14.3	10.8	31	130	10.0	3.2	127	-	137
V	mg/kg	255	29.0	11.4	34	251	20.5	6.2	245	-	265
Zn	mg/kg	96.3	10.96	11.4	175	96.4	7.60	1.04	94.7	-	97.9

Method: Extraction with boiling 2M HNO3

Element	Unit	Mean	Std.Dev.	CV %	N	Median	MAD	Uncertainty	95 % confidence limits		
Co	mg/kg	25.9	3.44	13.3	65	26.2	2.30	0.53	25.1	-	26.8
Cr	mg/kg	7.51	1.284	17.1	71	7.60	0.920	0.190	7.20	-	7.81
Cu	mg/kg	147	13.3	9.0	78	148	9.0	1.9	144.3	-	150.3
Mo	mg/kg	0.114	0.0264	23.1	17	0.120	0.0200	0.0080	0.101	-	0.128
Ni	mg/kg	8.62	1.477	17.1	72	8.56	1.035	0.218	8.27	-	8.96
Tl	mg/kg	0.216	0.0292	13.5	20	0.220	0.0200	0.0082	0.202	-	0.230



Consensus Values ISE 938



Method: Extraction with boiling 2M HNO3										(cont.)	
Element	Unit	Mean	Std.Dev.	CV %	N	Median	MAD	Uncertainty	95 % confidence limits		
Zn	mg/kg	59.2	7.73	13.0	75	58.5	5.20	1.12	57.5	-	61.0

Method: Extraction with 0.01M CaCl2 1:10											
Element	Unit	Mean	Std.Dev.	CV %	N	Median	MAD	Uncertainty	95 % confidence limits		
K	mg/kg	334	22.3	6.7	43	339	15.6	4.3	327	-	341
Mg	mg/kg	326	40.9	12.5	41	321	29.0	8.0	313	-	339
N - NO3 (as N)	mg/kg	26.6	2.71	10.2	24	26.3	1.75	0.69	25.4	-	27.7

Method: Soil characteristics											
Element	Unit	Mean	Std.Dev.	CV %	N	Median	MAD	Uncertainty	95 % confidence limits		
pH - CaCl2	...	5.85	0.203	3.5	72	5.86	0.145	0.030	5.80	-	5.90
pH - H2O	...	6.47	0.233	3.6	142	6.49	0.160	0.024	6.43	-	6.51
pH - KCl	...	5.34	0.132	2.5	73	5.37	0.090	0.019	5.31	-	5.37
Fraction < 2 µm	%	12.5	2.88	23.1	38	12.0	2.00	0.58	11.5	-	13.4

Method: Fluoride (Swiss standard procedure)											
Element	Unit	Mean	Std.Dev.	CV %	N	Median	MAD	Uncertainty	95 % confidence limits		
F - Total	mg/kg	143	18.4	12.9	25	146	13.0	4.6	135	-	151

Method: Water soluble 1:10 (w/v) (EN-12457-4)											
Element	Unit	Mean	Std.Dev.	CV %	N	Median	MAD	Uncertainty	95 % confidence limits		
F	mg/kg	14.0	1.54	11.0	22	13.9	1.10	0.41	13.3	-	14.7



Indicative Values ISE 938



Method: Real totals

Element	Unit	Mean	Std.Dev.	CV %	N	Median	MAD	Uncertainty	95 % confidence limits		
Ba	mg/kg	833	95.0	11.4	11	817	63.0	35.8	770	-	896
Co	mg/kg	40.2	7.40	18.4	12	39.4	5.25	2.67	35.5	-	44.8
K	mg/kg	4200	1238	29.5	22	4470	764	330	3660	-	4750
Ni	mg/kg	14.7	5.50	37.5	15	15.1	3.80	1.77	11.6	-	17.7
Rb	mg/kg	17.4	3.36	19.3	8	18.5	2.50	1.48	14.7	-	20.2
Si	g/kg	215	6.1	2.8	13	215	4.0	2.1	211.1	-	218.4
Sr	mg/kg	302	42.0	13.9	14	308	27.3	14.0	278	-	326
Zr	mg/kg	107	12.3	11.5	9	110	8.0	5.1	97.6	-	116

Method: Acid extractable (So-called totals)

Element	Unit	Mean	Std.Dev.	CV %	N	Median	MAD	Uncertainty	95 % confidence limits		
As	mg/kg	2.80	0.894	31.9	84	2.97	0.625	0.122	2.60	-	2.99
Be	mg/kg	0.631	0.1489	23.6	8	0.650	0.1050	0.0658	0.509	-	0.752
Cr	mg/kg	11.2	3.00	26.9	146	11.8	2.07	0.31	10.7	-	11.6
Li	mg/kg	7.88	2.085	26.5	14	8.25	1.440	0.697	6.68	-	9.08
Na	mg/kg	2170	674	31.1	84	2250	447	92	2023	-	2315

Method: Extraction with boiling 2M HNO3

Element	Unit	Mean	Std.Dev.	CV %	N	Median	MAD	Uncertainty	95 % confidence limits		
Cd	mg/kg	0.134	0.0426	31.8	64	0.140	0.0300	0.0067	0.123	-	0.145
Pb	mg/kg	2.74	1.078	39.3	52	3.00	0.770	0.187	2.44	-	3.04

Method: Extraction with 0.1M NaNO3

Element	Unit	Mean	Std.Dev.	CV %	N	Median	MAD	Uncertainty	95 % confidence limits		
Cu	µg/kg	26.8	12.45	46.6	29	30.0	9.30	2.89	22.0	-	31.5

Method: Extraction with 0.01M CaCl2 1:10

Element	Unit	Mean	Std.Dev.	CV %	N	Median	MAD	Uncertainty	95 % confidence limits		
Na	mg/kg	24.4	9.50	38.9	29	25.8	7.10	2.20	20.8	-	28.0

Method: Soil characteristics

Element	Unit	Mean	Std.Dev.	CV %	N	Median	MAD	Uncertainty	95 % confidence limits		
Org.matter (L.O.I.)	%	11.0	2.90	26.4	58	10.7	1.87	0.48	10.2	-	11.8
EC-SC (ISO 11265)	mS/m	10.1	3.74	37.2	55	10.0	2.53	0.63	9.05	-	11.1
Fraction < 63 µm	%	46.8	10.34	22.1	15	47.5	7.30	3.34	41.2	-	52.5



Indicative Values ISE 938

Method: Phosphorus and related analysis

Element	Unit	Mean	Std.Dev.	CV %	N	Median	MAD	Uncertainty	95 % confidence limits		
P - Olsen (as P)	mg/kg	10.1	3.85	38.2	46	9.93	2.60	0.71	8.94	-	11.2



Informative Values ISE 938



Method: Real totals

Element	Unit	Median	MAD	N	Results smaller than (<)	
					Median of <	N
As	mg/kg	3.95	0.500	6		
Cd	mg/kg	1.000	0.7700	7	0.250	7
Cr	mg/kg	21.9	13.10	17		
F	mg/kg	160	113.0	3		
Ga	mg/kg	23.5	3.60	6		
Hg	µg/kg	20.0	10.00	9		
Mo	mg/kg	4.73	3.270	3		
Pb	mg/kg	9.30	4.060	12		
S	mg/kg	349	26.5	6		
Y	mg/kg	25.0	2.00	4		

Method: Acid extractable (So-called totals)

Element	Unit	Median	MAD	N	Results smaller than (<)	
					Median of <	N
B	mg/kg	9.20	6.790	35	1.00	7
Cd	mg/kg	0.205	0.0850	70	0.300	74
Ga	mg/kg	18.9	3.90	4		
Hg	µg/kg	35.0	15.00	60	100.0	53
Mo	mg/kg	0.555	0.2800	20	2.000	23
Pb	mg/kg	4.18	2.055	92	5.00	55
Rb	mg/kg	11.0	-	3		
Sb	mg/kg	0.165	0.0700	12	5.000	15
Se	mg/kg	0.780	0.5200	15	4.000	13
Si	g/kg	0.550	0.3200	3		
Sn	mg/kg	2.41	1.610	13	5.00	15
Tl	mg/kg	0.260	0.0800	5		
Y	mg/kg	17.5	1.90	4		
Zr	mg/kg	13.9	0.75	6		

Method: Extraction with boiling 2M HNO3

Element	Unit	Median	MAD	N	Results smaller than (<)	
					Median of <	N
Hg	µg/kg	20.0	10.00	39	20.0	13

Method: Extraction with 0.1M NaNO3

Element	Unit	Median	MAD	N	Results smaller than (<)	
					Median of <	N



Informative Values ISE 938

Cd	µg/kg	0.825	0.4400	6	3.000	39
Ni	µg/kg	5.50	2.595	6	25.00	38
Pb	µg/kg	3.00	1.800	6	20.00	38

Method: Extraction with 0.1M NaNO3

Element	Unit	Median	MAD	N	Results smaller than (<) Median of <	N
Zn	µg/kg	38.0	16.00	13	50.0	32

(cont.)

Method: Extraction with 0.01M CaCl2 1:10

Element	Unit	Median	MAD	N
B	µg/kg	160	128.3	6
Cu	µg/kg	117	68.9	12
Fe	mg/kg	0.495	0.3450	10
Mn	mg/kg	0.815	0.3850	18
N - NH4 (as N)	mg/kg	2.16	0.710	19
N total soluble	mg/kg	32.5	2.60	7
P	mg/kg	0.325	0.2300	20
SO4	mg/kg	18.0	12.00	5
Zn	µg/kg	348	191.0	16

Method: Soil characteristics

Element	Unit	Median	MAD	N	Results smaller than (<) Median of <	N
TIC=Tot.Inorg C(as CaCO3)	%	0.900	0.7000	32	0.500	13
Fraction > 63 µm	%	44.8	5.10	7		

Method: Other determinations

Element	Unit	Median	MAD	N	Results smaller than (<) Median of <	N
CN - Free	mg/kg	-	-	0	0.500	7
CN - Total	mg/kg	0.600	0.4100	5	1.000	16

Method: Phosphorus and related analysis

Element	Unit	Median	MAD	N
P - Bray (as P)	mg/kg	3.00	1.300	29