



**WAGENINGEN EVALUATING PROGRAMS
FOR ANALYTICAL LABORATORIES**

Certificate of Analysis



International Plant-Analytical Exchange

REFERENCE MATERIAL

IPE sample 223



Certificate of Analysis IPE 223

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, the mean and standard deviation are calculated using all reported data when at least 4 results are left after removal of reported 'lower than' (<) and 0 (= zero) values. No outliers are removed.

This report is divided into two sections: Consensus Values and Indicative Values. The division is made on the reliability of the data. Consensus Values are based on at least 8 results and a maximum relative uncertainty of 6.25%. Indicative Values are based on a maximum relative uncertainty of 35% and a minimum of 4 and maximum of 7 results, or a relative uncertainty greater than 6.25% when there are at least 8 results.

For each determinand the following parameters are given: mean, standard deviation, coefficient of variation, number of results, median, MAD (Median of Absolute Deviation), the uncertainty of the mean (consensus or indicative) value and the relative uncertainty.

Please note: Most WEPAL-QUASIMEME reference materials are found to be stable over the long term (>10 years) for most determinand/matrix combinations. There are a few exceptions known to us as being less stable over the long term. These are organotins in sediment (MS6), ASP in shellfish (BT7), some PAHs and PCBs in sediment (SETOC) and N-NH₄ (as N) in clay soils (ISE).

All values, expressed on a weight basis (kg or %), are reported as oven-dried (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 IPE samples are dried at 70°C and milled to pass a 0.5 mm sieve.

This IPE sample 223 of Barley / *Hordeum vulgare*, from France, is prepared for the WEPAL proficiency programs. The sample has been used in 3 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
2026	1	1
2020	3	2
2015	4	2



Consensus Values IPE 223

Method: Inorganic Chemical Composition

Element	Unit	Mean	Std.Dev.	CV %	N	Median	MAD	Uncertainty	Rel.Uncert. %
Cu	mg/kg	4.86	0.565	11.6	262	4.91	0.355	0.044	0.897
Fe	mg/kg	30.9	5.52	17.8	250	31.5	3.51	0.436	1.41
Mn	mg/kg	14.9	1.60	10.7	256	14.9	0.970	0.125	0.840
Zn	mg/kg	25.3	2.31	9.1	268	25.5	1.53	0.177	0.698
Mo	µg/kg	338	36.7	10.9	75	339	19.7	5.30	1.57
Ba	mg/kg	2.32	0.257	11.1	28	2.35	0.183	0.061	2.62
Sr	mg/kg	1.26	0.150	11.9	22	1.28	0.090	0.040	3.17
Rb	µg/kg	2759	222	8.0	10	2759	137	87.7	3.18
Ca	g/kg	0.442	0.068	15.3	260	0.450	0.041	0.005	1.19
Cl (as Cl)	g/kg	1.29	0.184	14.3	48	1.30	0.115	0.033	2.57
K	g/kg	4.66	0.377	8.1	283	4.69	0.220	0.028	0.601
Mg	g/kg	1.12	0.085	7.6	275	1.12	0.057	0.006	0.571
N - Kjeldahl (as N)	g/kg	15.0	0.879	5.9	166	15.0	0.585	0.085	0.568
Na	mg/kg	81.7	21.6	26.4	157	82.0	13.8	2.15	2.63
P (as P)	g/kg	2.89	0.232	8.0	288	2.90	0.146	0.017	0.592
S (as S)	g/kg	1.12	0.102	9.1	167	1.12	0.070	0.010	0.883

Method: Real totals

Element	Unit	Mean	Std.Dev.	CV %	N	Median	MAD	Uncertainty	Rel.Uncert. %
C - elementary	g/kg	448	14.7	3.3	97	449	9.95	1.87	0.417
Si	mg/kg	2076	224	10.8	8	2055	106	99.0	4.77
N - elementary	g/kg	15.4	0.729	4.7	148	15.5	0.460	0.075	0.486

Method: Acid extractable (So-called totals)

Element	Unit	Mean	Std.Dev.	CV %	N	Median	MAD	Uncertainty	Rel.Uncert. %
Al	mg/kg	17.8	4.87	27.4	57	17.8	2.70	0.807	4.53

Method: Other determinations

Element	Unit	Mean	Std.Dev.	CV %	N	Median	MAD	Uncertainty	Rel.Uncert. %
delta 13C	‰ V-PDB	-27.9	0.308	1.1	14	-27.8	0.160	0.103	0.370
delta 15N	‰ Air	4.13	0.401	9.7	13	4.17	0.320	0.139	3.36

Method: Nutritional values

Element	Unit	Mean	Std.Dev.	CV %	N	Median	MAD	Uncertainty	Rel.Uncert. %
Crude fibre	g/kg	46.9	5.13	10.9	16	47.1	3.00	1.60	3.42
Total ash	g/kg	21.4	2.73	12.7	31	21.1	1.57	0.612	2.85

Indicative Values IPE 223

Method: Inorganic Chemical Composition

Element	Unit	Mean	Std.Dev.	CV %	N	Median	MAD	Uncertainty	Rel.Uncert. %
B	mg/kg	1.23	1.03	83.4	142	1.45	0.719	0.108	8.75
As	µg/kg	13.8	4.31	31.2	35	14.0	2.40	0.911	6.60
Cd	µg/kg	4.37	2.77	63.4	41	4.69	1.97	0.541	12.4
Co	µg/kg	6.99	2.78	39.8	24	7.47	1.90	0.710	10.2
Cr	µg/kg	253	108	42.6	52	278	73.0	18.7	7.39
Hg	µg/kg	0.924	0.727	78.7	24	0.970	0.485	0.186	20.1
Li	µg/kg	27.7	13.0	46.8	11	30.0	7.24	4.90	17.7
Ni	µg/kg	158	55.4	35.0	49	170	30.0	9.89	6.26
Pb	µg/kg	24.3	21.0	86.6	38	29.7	15.1	4.27	17.6
Se	µg/kg	17.9	11.2	62.5	26	19.8	6.83	2.75	15.3
Sb	µg/kg	4.57	3.59	78.5	9	5.94	2.37	1.49	32.7
Ti	mg/kg	0.387	0.198	51.3	8	0.410	0.122	0.088	22.7
V	µg/kg	21.2	5.12	24.1	17	22.4	3.40	1.55	7.31

Method: Real totals

Element	Unit	Mean	Std.Dev.	CV %	N	Median	MAD	Uncertainty	Rel.Uncert. %
Al	mg/kg	22.1	7.77	35.1	35	22.2	4.36	1.64	7.42
S - elementary	g/kg	1.15	0.076	6.6	4	1.12	0.040	0.047	4.13

Method: Acid extractable (So-called totals)

Element	Unit	Mean	Std.Dev.	CV %	N	Median	MAD	Uncertainty	Rel.Uncert. %
Si	mg/kg	282	28.4	10.1	5	292	19.1	15.9	5.63

Method: Nutritional values

Element	Unit	Mean	Std.Dev.	CV %	N	Median	MAD	Uncertainty	Rel.Uncert. %
ADF-ash-free	g/kg	56.2	10.5	18.7	8	55.9	7.35	4.66	8.28
NDF-ash-free	g/kg	165	23.9	14.5	8	166	17.0	10.6	6.41
Total fat	g/kg	22.4	11.3	50.4	12	24.9	7.55	4.08	18.2