



**WAGENINGEN EVALUATING PROGRAMS
FOR ANALYTICAL LABORATORIES**

Certificate of Analysis



International Plant-Analytical Exchange

REFERENCE MATERIAL

IPE sample 236



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.

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 236 of Barley (straw) / *Hordeum vulgare*, from Austria, 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
2023	4	3
2021	2	4
2018	2	3



Consensus Values IPE 236



Method: Inorganic Chemical Composition

Element	Unit	Mean	Std.Dev.	CV %	N	Median	MAD	Uncertainty	Rel.Uncert. %
B	mg/kg	3.53	1.23	34.7	190	3.65	0.763	0.111	3.15
Cu	mg/kg	4.35	0.606	13.9	270	4.33	0.342	0.046	1.06
Fe	mg/kg	431	50.4	11.7	264	430	33.3	3.88	0.899
Mn	mg/kg	21.0	1.74	8.3	263	20.9	1.10	0.134	0.638
Zn	mg/kg	19.9	1.93	9.7	273	19.9	1.20	0.146	0.732
As	µg/kg	328	38.3	11.7	57	329	22.0	6.34	1.93
Cd	µg/kg	29.8	3.59	12.0	66	30.0	2.11	0.553	1.85
Co	µg/kg	153	15.4	10.0	60	151	8.50	2.49	1.62
Cr	µg/kg	1359	264	19.4	65	1389	177	40.9	3.01
Hg	µg/kg	5.16	1.19	23.1	27	5.18	0.617	0.287	5.56
Mo	µg/kg	338	58.0	17.1	74	339	35.8	8.43	2.49
Ni	µg/kg	503	86.3	17.2	49	504	52.0	15.4	3.06
Pb	µg/kg	454	62.1	13.7	75	460	39.8	8.97	1.97
Ba	mg/kg	13.0	2.01	15.4	25	13.2	1.40	0.501	3.84
Sn	µg/kg	53.0	9.69	18.3	16	54.2	5.67	3.03	5.71
Sr	mg/kg	13.8	0.986	7.1	23	13.9	0.560	0.257	1.86
Be	µg/kg	21.8	3.30	15.2	10	21.6	1.60	1.31	6.00
Rb	µg/kg	2976	444	14.9	11	3104	307	167	5.62
Ca	g/kg	4.68	0.351	7.5	287	4.67	0.225	0.026	0.554
Cl (as Cl)	g/kg	8.07	0.799	9.9	52	8.05	0.400	0.139	1.72
K	g/kg	16.6	1.16	7.0	300	16.5	0.659	0.084	0.504
Mg	g/kg	1.63	0.125	7.6	287	1.63	0.072	0.009	0.563
N - Kjeldahl (as N)	g/kg	12.4	0.676	5.5	176	12.4	0.400	0.064	0.515
Na	mg/kg	304	43.0	14.2	167	304	25.7	4.16	1.37
P (as P)	g/kg	2.13	0.147	6.9	299	2.13	0.092	0.011	0.500
S (as S)	g/kg	1.85	0.143	7.8	170	1.85	0.085	0.014	0.744

Method: Real totals

Element	Unit	Mean	Std.Dev.	CV %	N	Median	MAD	Uncertainty	Rel.Uncert. %
C - elementary	g/kg	439	14.3	3.3	104	438	8.55	1.75	0.399
N - elementary	g/kg	12.9	0.625	4.9	148	12.8	0.350	0.064	0.499

Method: Acid extractable (So-called totals)

Element	Unit	Mean	Std.Dev.	CV %	N	Median	MAD	Uncertainty	Rel.Uncert. %
Al	mg/kg	451	112	24.8	65	450	74.0	17.4	3.85



Consensus Values IPE 236

Method: Other determinations

Element	Unit	Mean	Std.Dev.	CV %	N	Median	MAD	Uncertainty	Rel.Uncert. %
delta 13C	‰ V-PDB	-28.6	0.236	0.8	27	-28.6	0.150	0.057	0.198
delta 15N	‰ Air	1227	32.0	2.6	26	1227	20.2	7.86	0.640

Method: Nutritional values

Element	Unit	Mean	Std.Dev.	CV %	N	Median	MAD	Uncertainty	Rel.Uncert. %
Crude fibre	g/kg	204	17.5	8.6	18	206	6.10	5.17	2.54
ADF-ash-free	g/kg	229	14.9	6.5	10	231	7.00	5.87	2.57
NDF-ash-free	g/kg	451	18.7	4.1	10	448	10.5	7.38	1.64
Total ash	g/kg	72.9	3.98	5.5	42	72.5	2.58	0.768	1.05



Indicative Values IPE 236

Method: Inorganic Chemical Composition

Element	Unit	Mean	Std.Dev.	CV %	N	Median	MAD	Uncertainty	Rel.Uncert. %
I	µg/kg	86.9	17.8	20.5	9	90.0	10.0	7.42	8.54
Li	µg/kg	506	100	19.8	14	514	36.9	33.5	6.62
Se	µg/kg	60.5	20.8	34.4	35	65.8	15.8	4.40	7.28
Bi	µg/kg	5.66	2.97	52.5	4	6.50	1.59	1.86	32.8
Sb	µg/kg	17.6	6.08	34.5	16	17.8	4.25	1.90	10.8
Ti	mg/kg	9.72	4.05	41.7	18	10.7	2.56	1.19	12.3
V	µg/kg	909	220	24.1	22	901	158	58.5	6.43
Ag	µg/kg	3.33	1.47	44.2	5	3.23	0.890	0.824	24.7
N - NO3 (as N)	mg/kg	18.6	11.2	60.1	13	19.2	6.28	3.88	20.8
SO4 (as SO4)	g/kg	2.29	0.887	38.7	8	2.57	0.395	0.392	17.1

Method: Real totals

Element	Unit	Mean	Std.Dev.	CV %	N	Median	MAD	Uncertainty	Rel.Uncert. %
Al	mg/kg	674	225	33.3	30	681	166	51.3	7.60
Si	mg/kg	8878	1108	12.5	7	8600	654	524	5.90

Method: Acid extractable (So-called totals)

Element	Unit	Mean	Std.Dev.	CV %	N	Median	MAD	Uncertainty	Rel.Uncert. %
Si	mg/kg	6582	4228	64.2	11	6549	3819	1594	24.2

Method: Nutritional values

Element	Unit	Mean	Std.Dev.	CV %	N	Median	MAD	Uncertainty	Rel.Uncert. %
Total fat	g/kg	23.2	7.46	32.2	17	23.1	4.10	2.26	9.76