



**WAGENINGEN EVALUATING PROGRAMS
FOR ANALYTICAL LABORATORIES**

Certificate of Analysis



International Plant-Analytical Exchange

REFERENCE MATERIAL

IPE sample 150



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 IPE samples are dried at 70 °C and milled to pass a 0.5 mm sieve.

This IPE sample 150 of Barley (grain) / *Hordeum vulgare* from Netherlands is prepared for the WEPAL proficiency programs. The sample is used in 5 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
2018	4	2
2013	4	2
2009	3	4
2006	1	3
2004	2	4



Consensus Values IPE 150



Method: Inorganic Chemical Composition

Element	Unit	Mean	Std.Dev.	CV %	N	Median	MAD	Uncertainty	95 % confidence limits		
As	µg/kg	65.2	9.70	14.9	91	68.0	7.00	1.27	63.2	-	67.2
Ba	mg/kg	1.46	0.151	10.3	50	1.49	0.105	0.027	1.42	-	1.51
Ca	g/kg	0.970	0.0999	10.3	579	0.980	0.0697	0.0052	0.961	-	0.978
Cd	µg/kg	21.0	4.17	19.8	125	22.0	3.00	0.47	20.3	-	21.7
Cl (as Cl)	g/kg	1.59	0.159	10.0	122	1.60	0.110	0.018	1.56	-	1.62
Cu	mg/kg	5.06	0.558	11.0	542	5.09	0.387	0.030	5.01	-	5.10
Fe	mg/kg	86.8	10.58	12.2	546	86.3	7.25	0.57	85.9	-	87.7
K	g/kg	5.97	0.411	6.9	592	5.96	0.285	0.021	5.94	-	6.00
Li	µg/kg	406	24.1	5.9	23	408	16.0	6.3	396	-	417
Mg	g/kg	1.23	0.087	7.1	589	1.23	0.061	0.004	1.22	-	1.24
Mn	mg/kg	9.56	0.999	10.5	553	9.61	0.680	0.053	9.47	-	9.64
Mo	µg/kg	400	38.7	9.7	121	400	27.0	4.4	393	-	407
N - Kjeldahl (as N)	g/kg	13.7	0.74	5.4	393	13.7	0.51	0.05	13.61	-	13.76
Na	mg/kg	137	18.5	13.5	345	139	13.0	1.2	135.0	-	138.9
P (as P)	g/kg	3.89	0.218	5.6	593	3.89	0.151	0.011	3.87	-	3.91
Rb	µg/kg	8290	432	5.2	18	8230	297	127	8072	-	8500
S (as S)	g/kg	1.37	0.129	9.4	339	1.37	0.090	0.009	1.35	-	1.38
Sr	mg/kg	4.72	0.365	7.7	58	4.79	0.252	0.060	4.62	-	4.81
V	µg/kg	97.1	20.15	20.8	33	103.0	14.20	4.38	89.9	-	104
Zn	mg/kg	27.5	2.04	7.4	564	27.5	1.40	0.11	27.35	-	27.69

Method: Real totals

Element	Unit	Mean	Std.Dev.	CV %	N	Median	MAD	Uncertainty	95 % confidence limits		
C - elementary	g/kg	438	13.6	3.1	140	440	9.3	1.4	435.9	-	440.4
N - elementary	g/kg	14.1	0.58	4.1	238	14.1	0.40	0.05	14.02	-	14.16

Method: Acid extractable (So-called totals)

Element	Unit	Mean	Std.Dev.	CV %	N	Median	MAD	Uncertainty	95 % confidence limits		
Al	mg/kg	40.3	9.58	23.8	118	40.5	6.50	1.10	38.5	-	42.0

Method: Nutritional values

Element	Unit	Mean	Std.Dev.	CV %	N	Median	MAD	Uncertainty	95 % confidence limits		
Crude fibre	g/kg	40.5	3.80	9.4	30	39.9	2.52	0.87	39.1	-	41.9
Total ash	g/kg	35.9	1.48	4.1	50	36.0	1.00	0.26	35.5	-	36.3



Indicative Values IPE 150

Method: Inorganic Chemical Composition

Element	Unit	Mean	Std.Dev.	CV %	N	Median	MAD	Uncertainty	95 % confidence limits	
B	mg/kg	1.94	0.839	43.4	344	2.02	0.585	0.057	1.85	- 2.03
Co	µg/kg	17.8	7.52	42.2	71	19.0	5.40	1.12	16.1	- 19.6
Cr	µg/kg	226	79.2	35.0	105	236	56.0	9.7	211	- 242
Hg	µg/kg	1.53	0.731	47.8	77	1.64	0.540	0.104	1.36	- 1.70
I	µg/kg	106	47.6	45.0	8	117	33.9	21.0	67.0	- 145
Pb	µg/kg	122	58.6	47.8	129	126	41.1	6.4	112	- 133
Sb	µg/kg	3.99	1.585	39.7	16	4.18	1.180	0.495	3.15	- 4.83
Se	µg/kg	47.4	12.54	26.5	46	51.4	9.17	2.31	43.7	- 51.1
SO4 (as SO4)	g/kg	0.716	0.3572	49.9	18	0.819	0.2518	0.1052	0.539	- 0.893

Method: Real totals

Element	Unit	Mean	Std.Dev.	CV %	N	Median	MAD	Uncertainty	95 % confidence limits	
Al	mg/kg	54.4	20.62	37.9	40	56.7	14.05	4.07	47.8	- 61.0

Method: Other determinations

Element	Unit	Mean	Std.Dev.	CV %	N	Median	MAD	Uncertainty	95 % confidence limits	
delta 13C	‰ V-PDB	-27.8	0.23	0.8	9	-27.9	0.16	0.09	-28.02	- -27.68
delta 15N	‰ Air	2.07	0.260	12.6	8	2.07	0.180	0.115	1.85	- 2.28

Method: Nutritional values

Element	Unit	Mean	Std.Dev.	CV %	N	Median	MAD	Uncertainty	95 % confidence limits	
ADF-ash-free	g/kg	53.1	5.63	10.6	13	54.8	4.03	1.95	49.7	- 56.5
NDF-ash-free	g/kg	137	15.8	11.5	9	138	11.0	6.6	126	- 149
Total fat	g/kg	22.6	5.51	24.4	15	21.9	3.79	1.78	19.6	- 25.6



Informative Values IPE 150

Method: Inorganic Chemical Composition

Element	Unit	Median	MAD	N	Results smaller than (<)	
					Median of <	N
Ag	µg/kg	2.54	0.720	3	10.00	8
Be	µg/kg	4.90	2.534	8	20.00	30
Bi	µg/kg	-	-	0	11.3	16
Br	mg/kg	17.5	0.30	3		
Cs	µg/kg	13.5	0.62	5		
Ga	µg/kg	66.6	7.40	3		
N - NH4 (as N)	mg/kg	50.5	17.58	18		
N - NO3 (as N)	mg/kg	18.3	11.37	28	25.0	29
Ni	µg/kg	140	48.5	92	350	65
Sn	µg/kg	34.3	20.27	13	550.0	8
Ti	mg/kg	2.88	1.960	9	8.13	6

Method: Real totals

Element	Unit	Median	MAD	N
Si	mg/kg	5590	230	6

Method: Acid extractable (So-called totals)

Element	Unit	Median	MAD	N
Si	mg/kg	2160	2139	10

Method: Nutritional values

Element	Unit	Median	MAD	N
NDF-ash-containing	g/kg	274	124.3	5