**WAGENINGEN EVALUATING PROGRAMS**

**FOR ANALYTICAL LABORATORIES**

# Certificate of Analysis

**International Plant-Analytical Exchange**

**REFERENCE MATERIAL**

**IPE sample 133**

WAGENINGEN
UNIVERSITY & RESEARCH

# Certificate of Analysis IPE 133

## 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 133 of Maize (plant) / Zea mays, from Netherlands, is prepared for the WEPAL proficiency programs. The sample has been 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 |
|---|---|---|
| 2016 | 1 | 3 |
| 2010 | 4 | 1 |
| 2006 | 3 | 3 |
| 2003 | 2 | 3 |
| 1999 | 5 | 1 |

## Consensus Values IPE 133

**Method: Inorganic Chemical Composition**

| Element | Unit | Mean | Std.Dev. | CV % | N | Median | MAD | Uncertainty | Rel.Uncert. % |
|---|---|---|---|---|---|---|---|---|---|
| B | mg/kg | 3.38 | 1.22 | 36.2 | 383 | 3.48 | 0.770 | 0.078 | 2.31 |
| Cu | mg/kg | 6.51 | 0.705 | 10.8 | 568 | 6.50 | 0.470 | 0.037 | 0.568 |
| Fe | mg/kg | 190 | 22.0 | 11.6 | 571 | 189 | 13.9 | 1.15 | 0.606 |
| Mn | mg/kg | 122 | 8.56 | 7.0 | 596 | 121 | 5.29 | 0.438 | 0.360 |
| Zn | mg/kg | 47.6 | 3.77 | 7.9 | 596 | 47.6 | 2.46 | 0.193 | 0.406 |
| As | µg/kg | 144 | 23.9 | 16.6 | 91 | 142 | 14.7 | 3.13 | 2.18 |
| Cd | µg/kg | 259 | 29.7 | 11.5 | 204 | 259 | 20.0 | 2.60 | 1.00 |
| Co | µg/kg | 81.0 | 12.9 | 15.9 | 111 | 81.0 | 7.70 | 1.53 | 1.88 |
| Cr | µg/kg | 456 | 120 | 26.2 | 150 | 467 | 83.0 | 12.2 | 2.68 |
| Hg | µg/kg | 5.38 | 0.951 | 17.7 | 88 | 5.40 | 0.595 | 0.127 | 2.36 |
| Mo | µg/kg | 170 | 36.3 | 21.3 | 108 | 175 | 20.0 | 4.36 | 2.56 |
| Ni | µg/kg | 523 | 82.5 | 15.8 | 163 | 525 | 48.0 | 8.08 | 1.54 |
| Pb | µg/kg | 920 | 114 | 12.4 | 182 | 921 | 63.0 | 10.6 | 1.15 |
| Se | µg/kg | 23.6 | 7.16 | 30.3 | 41 | 24.7 | 4.60 | 1.40 | 5.91 |
| Ba | mg/kg | 3.55 | 0.541 | 15.2 | 66 | 3.59 | 0.345 | 0.083 | 2.35 |
| V | µg/kg | 402 | 59.1 | 14.7 | 58 | 409 | 29.5 | 9.70 | 2.41 |
| Sr | mg/kg | 3.32 | 0.335 | 10.1 | 64 | 3.34 | 0.210 | 0.052 | 1.58 |
| Rb | µg/kg | 3202 | 316 | 9.9 | 20 | 3210 | 159 | 88.5 | 2.76 |
| Ca | g/kg | 1.87 | 0.178 | 9.6 | 609 | 1.87 | 0.108 | 0.009 | 0.484 |
| Cl (as Cl) | g/kg | 1.21 | 0.170 | 14.1 | 125 | 1.21 | 0.105 | 0.019 | 1.58 |
| K | g/kg | 7.88 | 0.533 | 6.8 | 611 | 7.90 | 0.313 | 0.027 | 0.342 |
| Mg | g/kg | 1.15 | 0.086 | 7.4 | 611 | 1.15 | 0.054 | 0.004 | 0.376 |
| N - Kjeldahl (as N) | g/kg | 11.6 | 0.638 | 5.5 | 398 | 11.6 | 0.407 | 0.040 | 0.346 |
| N - NO3 (as N) | mg/kg | 206 | 29.0 | 14.1 | 64 | 209 | 18.9 | 4.54 | 2.20 |
| Na | mg/kg | 104 | 29.6 | 28.4 | 363 | 106 | 16.4 | 1.94 | 1.86 |
| P (as P) | g/kg | 1.49 | 0.106 | 7.1 | 609 | 1.50 | 0.069 | 0.005 | 0.359 |
| S (as S) | g/kg | 0.931 | 0.093 | 10.0 | 342 | 0.930 | 0.060 | 0.006 | 0.676 |

**Method: Real totals**

| Element | Unit | Mean | Std.Dev. | CV % | N | Median | MAD | Uncertainty | Rel.Uncert. % |
|---|---|---|---|---|---|---|---|---|---|
| C - elementary | g/kg | 452 | 13.5 | 3.0 | 139 | 452 | 8.00 | 1.43 | 0.317 |
| N - elementary | g/kg | 12.0 | 0.706 | 5.9 | 239 | 12.0 | 0.448 | 0.057 | 0.474 |

**Method: Acid extractable (So-called totals)**

| Element | Unit | Mean | Std.Dev. | CV % | N | Median | MAD | Uncertainty | Rel.Uncert. % |
|---|---|---|---|---|---|---|---|---|---|
| Al | mg/kg | 83.6 | 14.7 | 17.6 | 107 | 83.0 | 10.6 | 1.77 | 2.12 |

## Consensus Values IPE 133

**Method: Nutritional values**

| Element | Unit | Mean | Std.Dev. | CV % | N | Median | MAD | Uncertainty | Rel.Uncert. % |
|---|---|---|---|---|---|---|---|---|---|
| Crude fibre | g/kg | 167 | 13.9 | 8.3 | 27 | 165 | 9.00 | 3.34 | 2.00 |
| ADF-ash-free | g/kg | 206 | 7.35 | 3.6 | 11 | 207 | 4.00 | 2.77 | 1.35 |
| NDF-ash-free | g/kg | 403 | 33.4 | 8.3 | 11 | 410 | 14.0 | 12.6 | 3.13 |
| Total ash | g/kg | 38.2 | 2.00 | 5.2 | 50 | 38.0 | 1.25 | 0.354 | 0.927 |

## Indicative Values IPE 133

**Method: Inorganic Chemical Composition**

| Element | Unit | Mean | Std.Dev. | CV % | N | Median | MAD | Uncertainty | Rel.Uncert. % |
|---|---|---|---|---|---|---|---|---|---|
| Br | mg/kg | 5.93 | 1.15 | 19.4 | 8 | 6.02 | 0.700 | 0.509 | 8.59 |
| I | µg/kg | 218 | 138 | 63.4 | 13 | 264 | 103 | 48.0 | 22.0 |
| Li | µg/kg | 79.4 | 24.7 | 31.1 | 20 | 80.0 | 15.0 | 6.90 | 8.69 |
| Bi | µg/kg | 4.97 | 5.32 | 107.0 | 10 | 7.42 | 3.95 | 2.10 | 42.3 |
| Sb | µg/kg | 31.0 | 13.7 | 44.0 | 28 | 32.2 | 6.00 | 3.23 | 10.4 |
| Sn | µg/kg | 71.4 | 28.8 | 40.4 | 13 | 68.1 | 12.2 | 9.99 | 14.0 |
| Ti | mg/kg | 2.69 | 1.94 | 72.1 | 16 | 2.92 | 1.28 | 0.607 | 22.5 |
| Ag | µg/kg | 7.77 | 3.00 | 38.6 | 7 | 6.87 | 3.13 | 1.42 | 18.2 |
| Be | µg/kg | 6.91 | 3.56 | 51.4 | 23 | 7.50 | 2.50 | 0.927 | 13.4 |
| Cs | µg/kg | 15.9 | 1.58 | 10.0 | 7 | 15.6 | 1.00 | 0.748 | 4.71 |
| N - NH4 (as N) | mg/kg | 56.5 | 55.1 | 97.6 | 17 | 73.4 | 42.4 | 16.7 | 29.6 |
| SO4 (as SO4) | g/kg | 0.140 | 0.096 | 69.0 | 20 | 0.160 | 0.060 | 0.027 | 19.3 |

**Method: Real totals**

| Element | Unit | Mean | Std.Dev. | CV % | N | Median | MAD | Uncertainty | Rel.Uncert. % |
|---|---|---|---|---|---|---|---|---|---|
| Al | mg/kg | 143 | 83.0 | 58.1 | 49 | 147 | 72.5 | 14.8 | 10.4 |
| Si | mg/kg | 5703 | 1731 | 30.3 | 6 | 6076 | 614 | 883 | 15.5 |

**Method: Acid extractable (So-called totals)**

| Element | Unit | Mean | Std.Dev. | CV % | N | Median | MAD | Uncertainty | Rel.Uncert. % |
|---|---|---|---|---|---|---|---|---|---|
| Si | mg/kg | 690 | 1620 | 234.7 | 10 | 825 | 824 | 641 | 92.8 |

**Method: Other determinations**

| Element | Unit | Mean | Std.Dev. | CV % | N | Median | MAD | Uncertainty | Rel.Uncert. % |
|---|---|---|---|---|---|---|---|---|---|
| delta 13C | ‰ V-PDB | -12.1 | 0.234 | 1.9 | 7 | -12.0 | 0.110 | 0.110 | 0.913 |
| delta 15N | ‰ Air | 6.19 | 0.340 | 5.5 | 7 | 6.25 | 0.170 | 0.161 | 2.60 |

**Method: Nutritional values**

| Element | Unit | Mean | Std.Dev. | CV % | N | Median | MAD | Uncertainty | Rel.Uncert. % |
|---|---|---|---|---|---|---|---|---|---|
| Total fat | g/kg | 21.6 | 6.29 | 29.1 | 12 | 22.4 | 3.48 | 2.27 | 10.5 |