Challenges in establishing the mineral composition of feed materials

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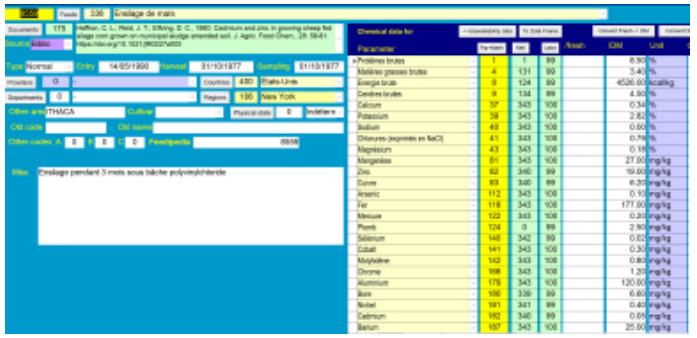
Mineral elements in the French Feed Database

The French Feed Database (FFD) has been collecting laboratory data on feed materials for more than 30 years.

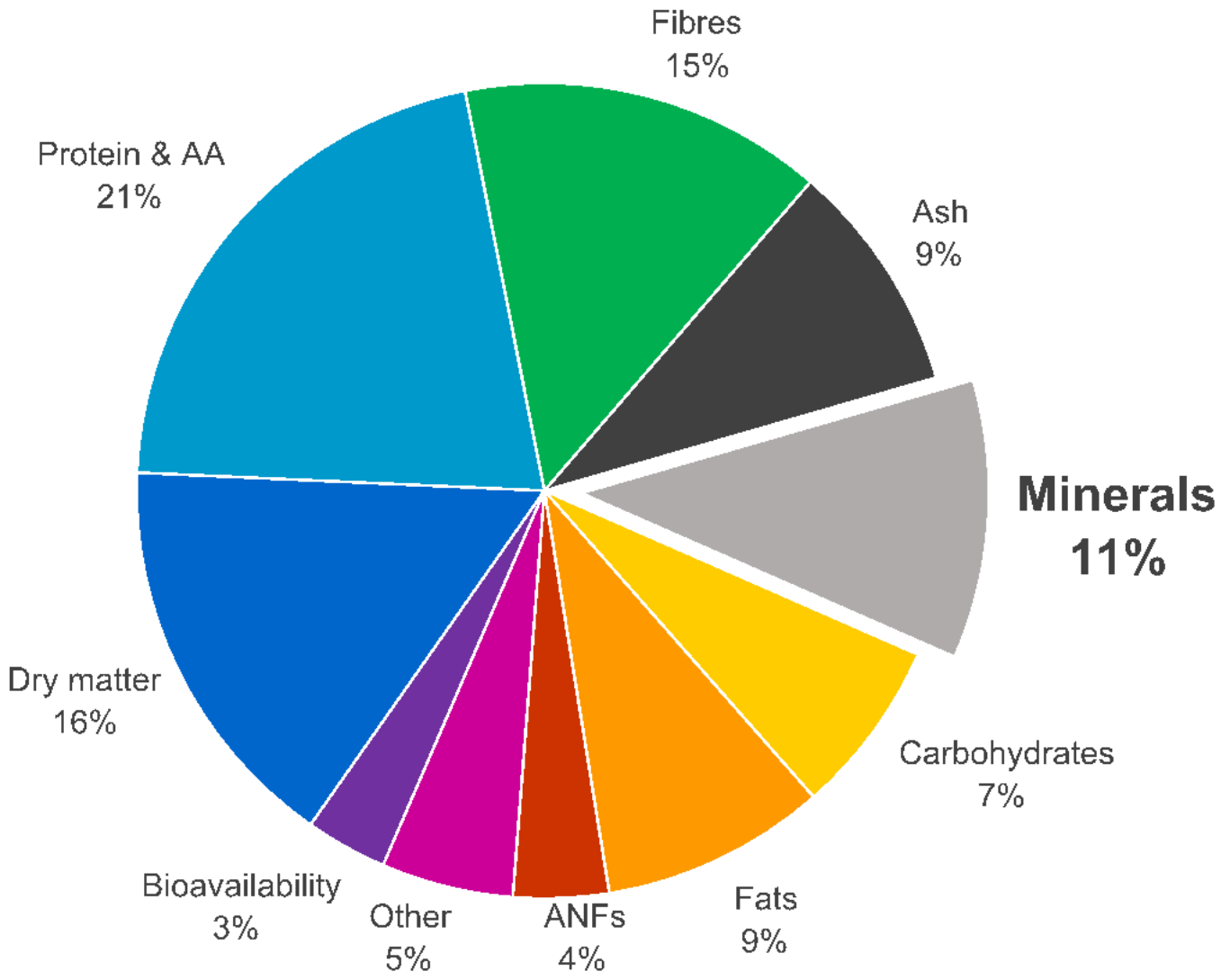


- **3 million** individual data
- **640,000** samples
- **7000** different feed materials
- **1300** chemical, physical, and bioavailability parameters
  - of those, **33 are mineral elements**: macrominerals (Ca, P, K, Mg, Na, Cl) and trace minerals (Fe, Cu, Zn, etc.)

Just a small window in the world of feed analysis!

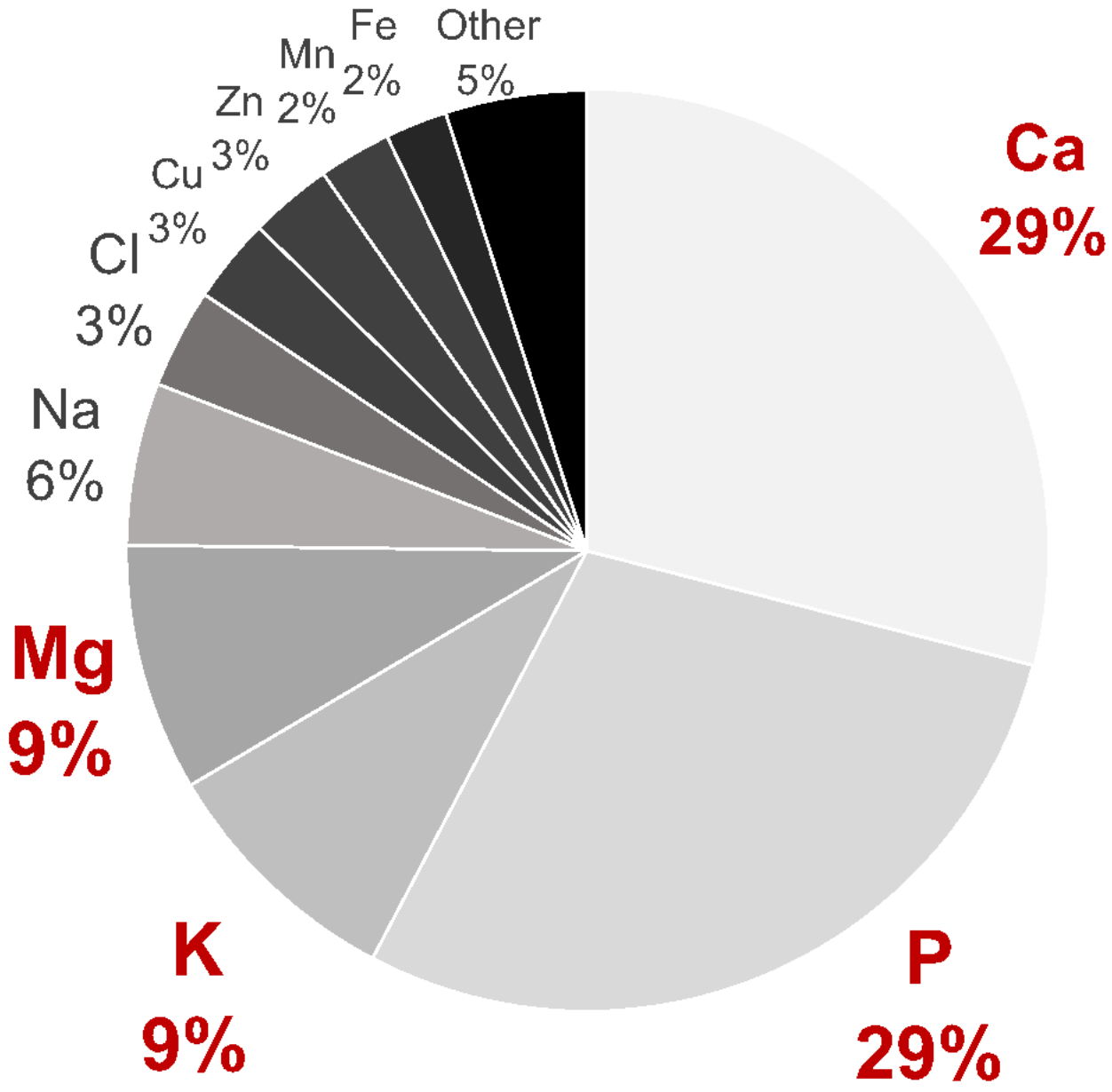
Mineral data availability

- 327,000 individual mineral data : 11% of the total data
- Less than dry matter, protein or fibres
- Crude ash still the main “mineral parameter”



Mineral data availability

- Ca, P, K, Mg: **76%** of the mineral data (85% with Na and Cl)
- Ca and P are usually measured together
- The main trace minerals are Cu, Zn, Mn and Fe: **11%** of the mineral data
- All other minerals: **5%** of the mineral data, ie **0.6%** of the total data

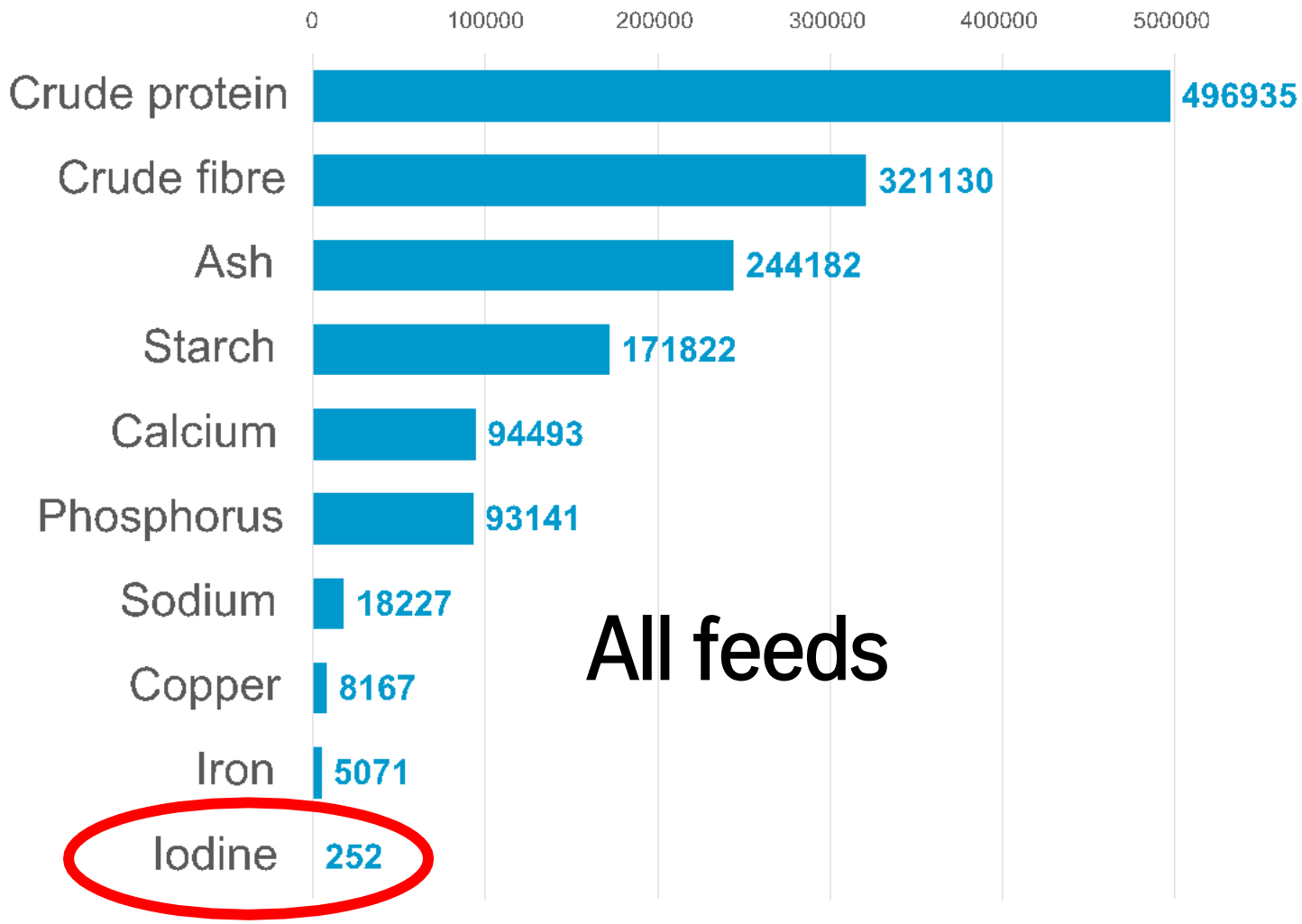


Mineral data availability

Half a million crude protein values...

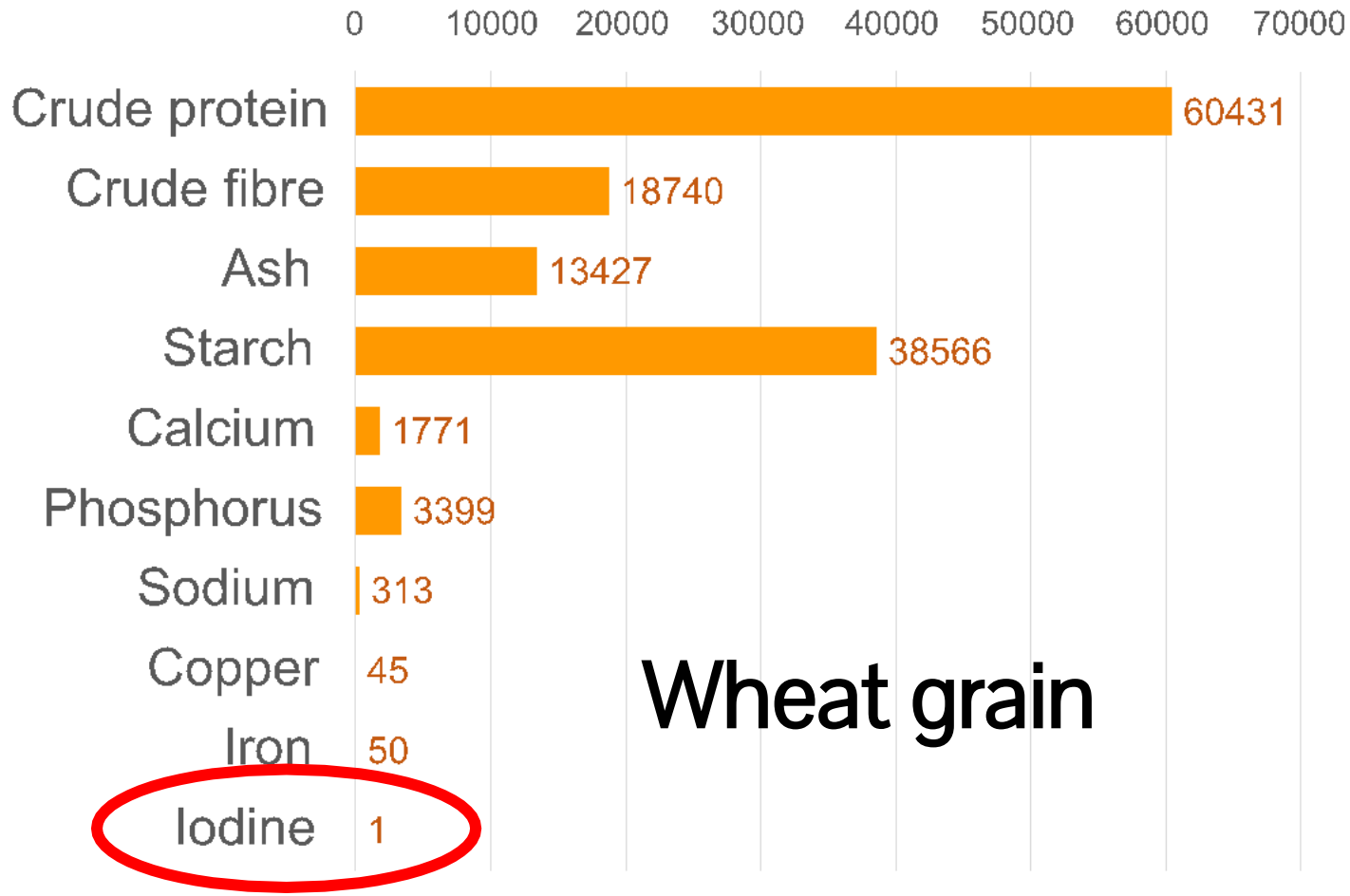
Only 252 values for iodine in all the database!

And about 50 of them are on iodine-based mineral products (potassium iodine, calcium iodate)



Mineral data availability

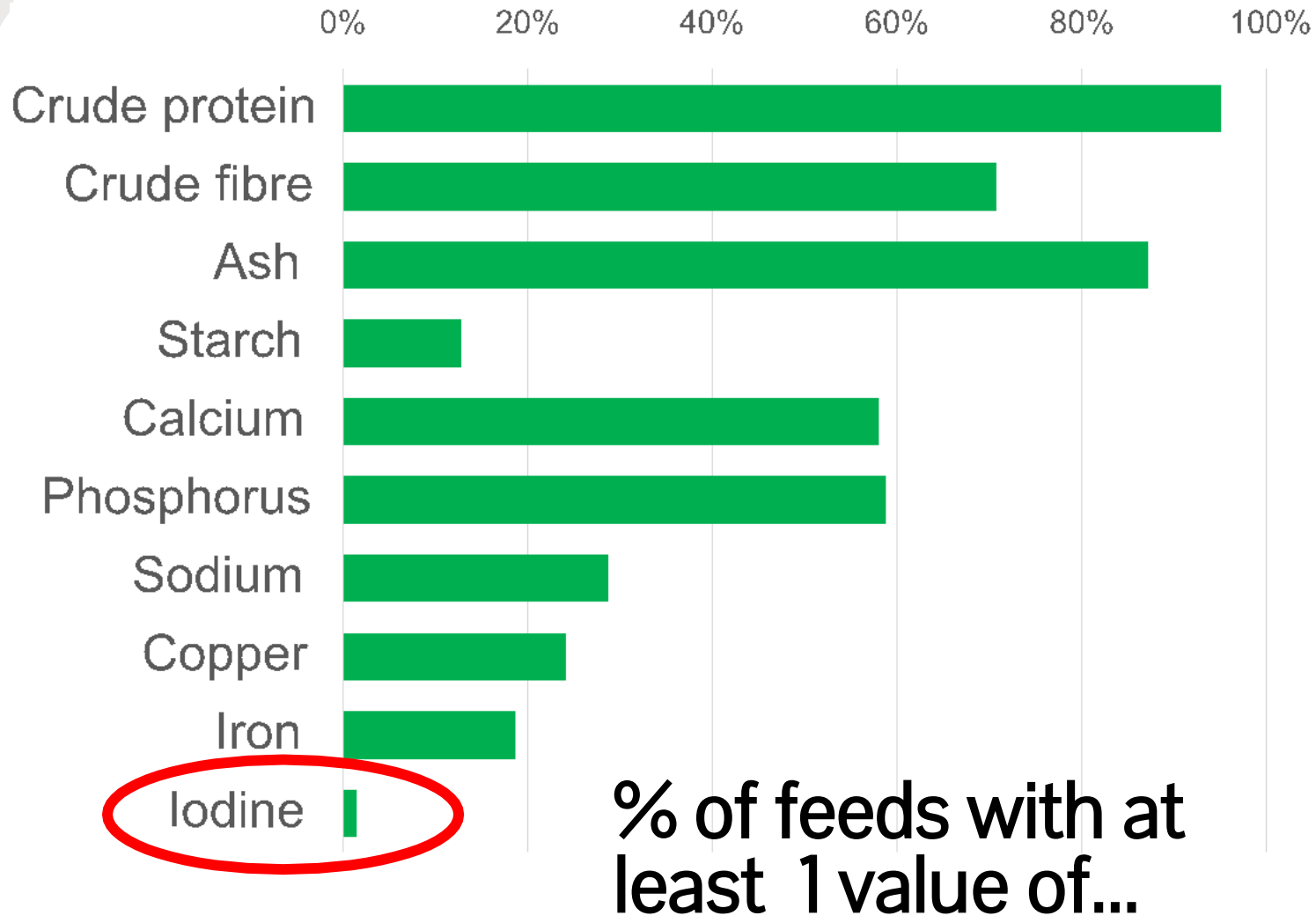
Only 1 value for iodine for wheat grain!



Mineral data availability

Out of 7000 different feeds:

- 95% have protein values
- 58% have Ca and P values
- 24% have Cu values
- 19% have Fe values
- 1% have iodine values



Challenge N°1

Mineral data availability remains insufficient

We know less about minerals in feed materials than we think…

- Coverage is correct for macro-minerals and for the major feeds.
- Insufficient for other minerals and lesser feeds
- There are many feeds in the FFD with no good mineral coverage
- When creating feed tables, it may be necessary to “borrow” values from other tables (including food tables)

The challenge of variability

In addition to the usual sources of variability (genetics, processes, environmental and cultural practices, analytical methods), mineral composition is influenced by the **presence of foreign material** such as dirt and dust collected at harvest, storage or during transport.

A topic well covered yesterday by Prof. Weiss!

The challenge of variability

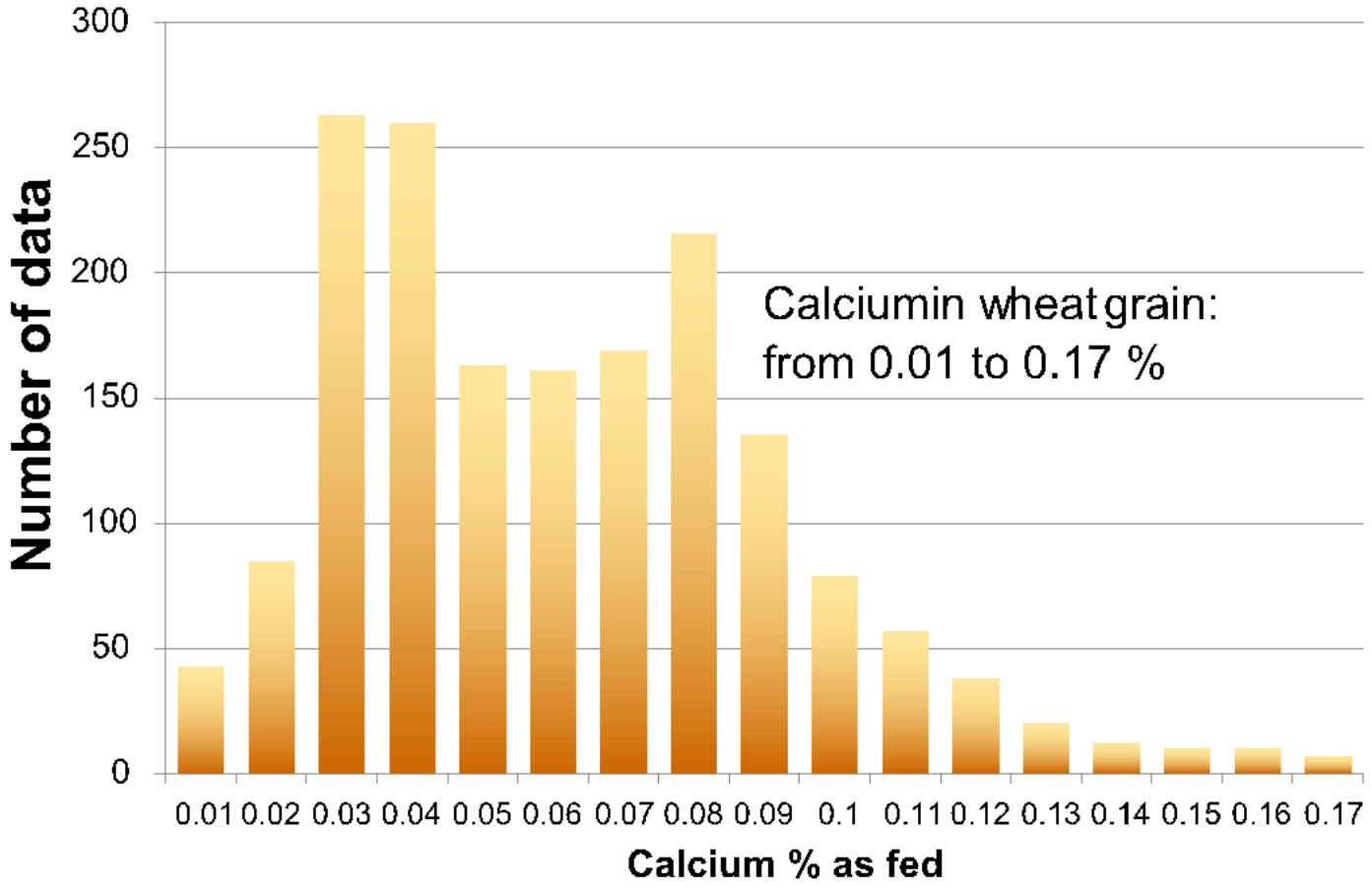
Generally, **there are no "hard" limits in the range of minerals**, which can cover several orders of magnitudes.

- Minimum value sometimes close to 0 or under the limit of detection
- Maximum value 2 to 10 times or more the minimum value
- Outlier values can be much higher due to contamination, analytical errors, typos…

The challenge of variability

Calcium in wheat grains

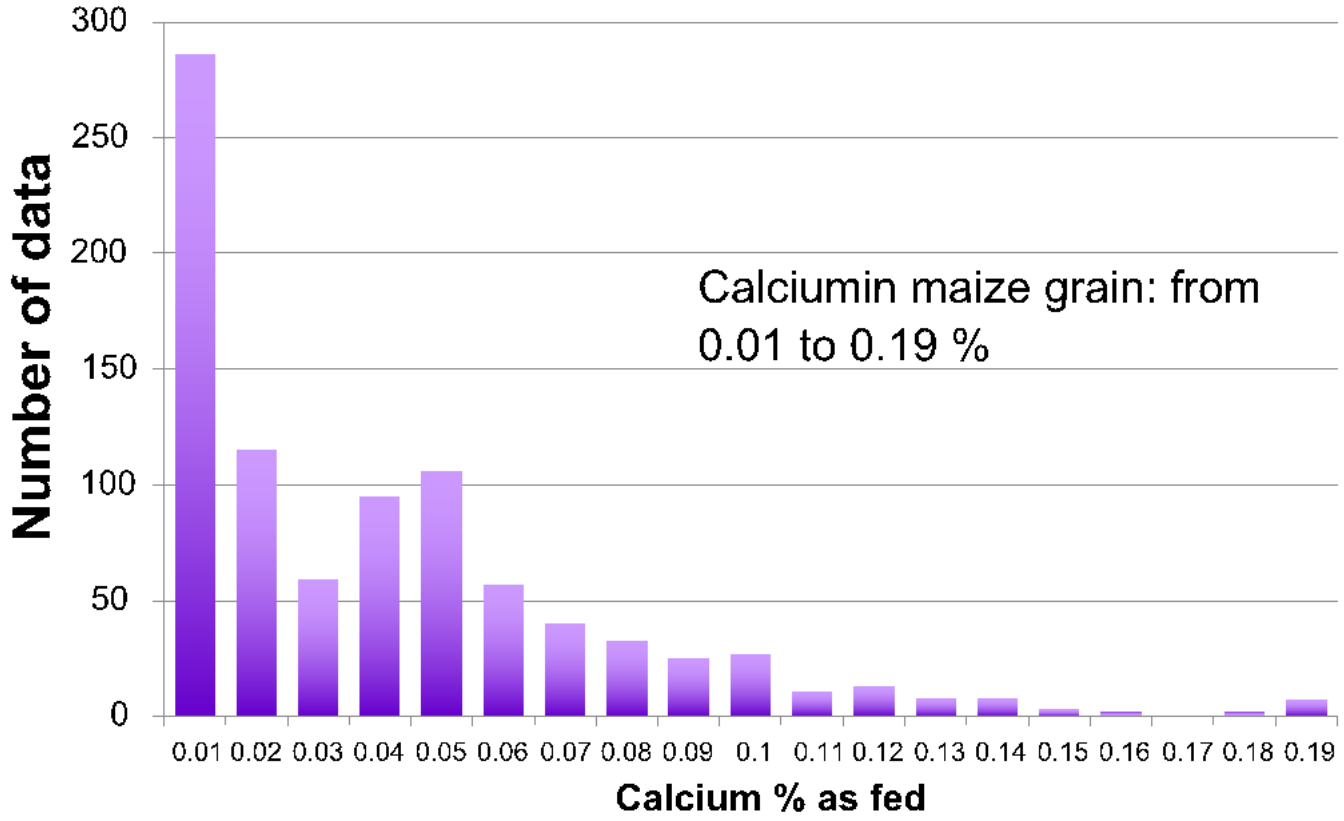
- Vaguely normal, skewed distribution
- Values range from 0.01 to 0.17%



The challenge of variability

Calcium in maize grains

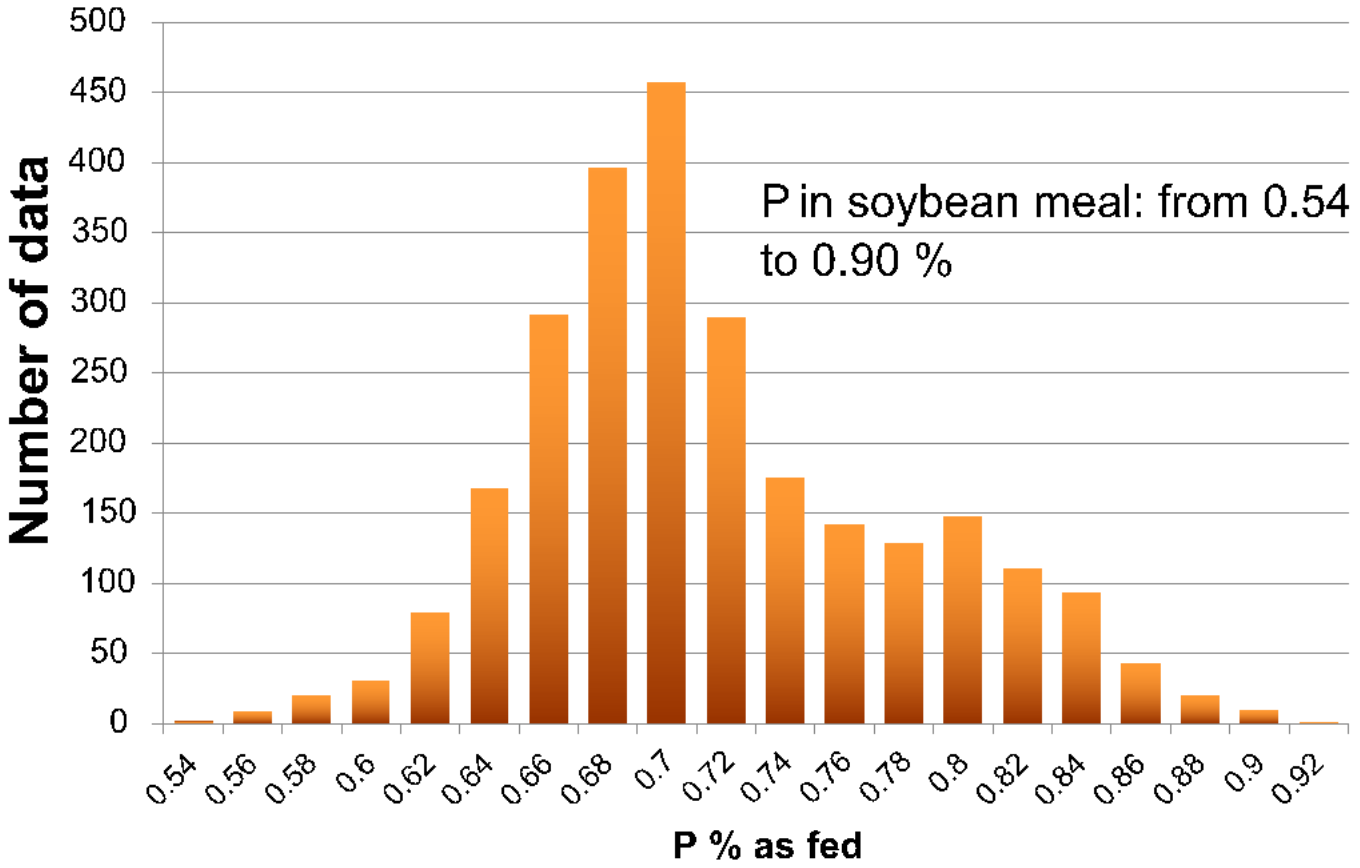
- Very skewed distribution
- Values range from 0.01 to 0.19%



The challenge of variability

Phosphorus in all soybean meals

- Bimodal distribution

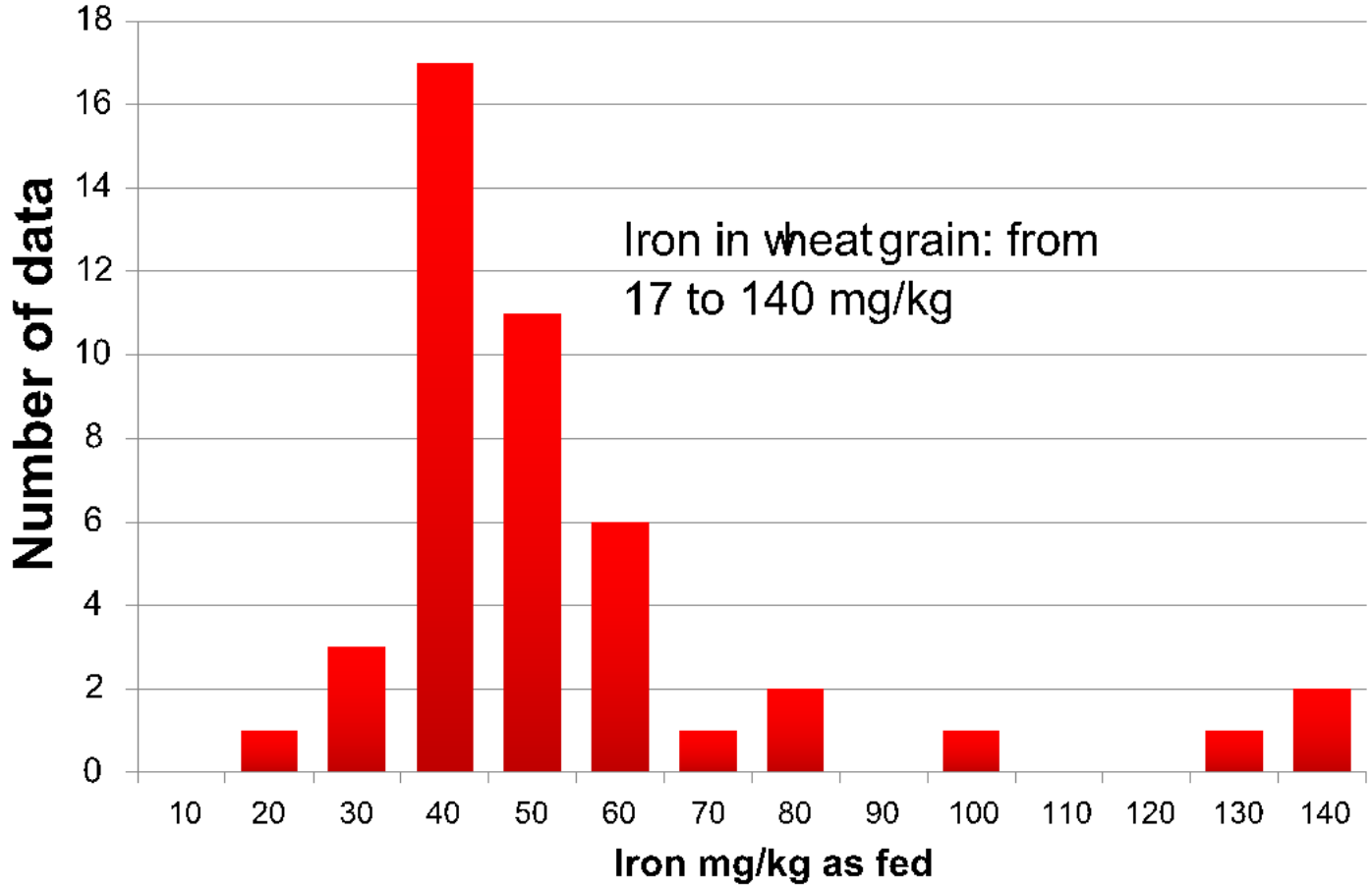


The challenge of variability

Iron in wheat grains

Are the outliers > 90 mg/kg

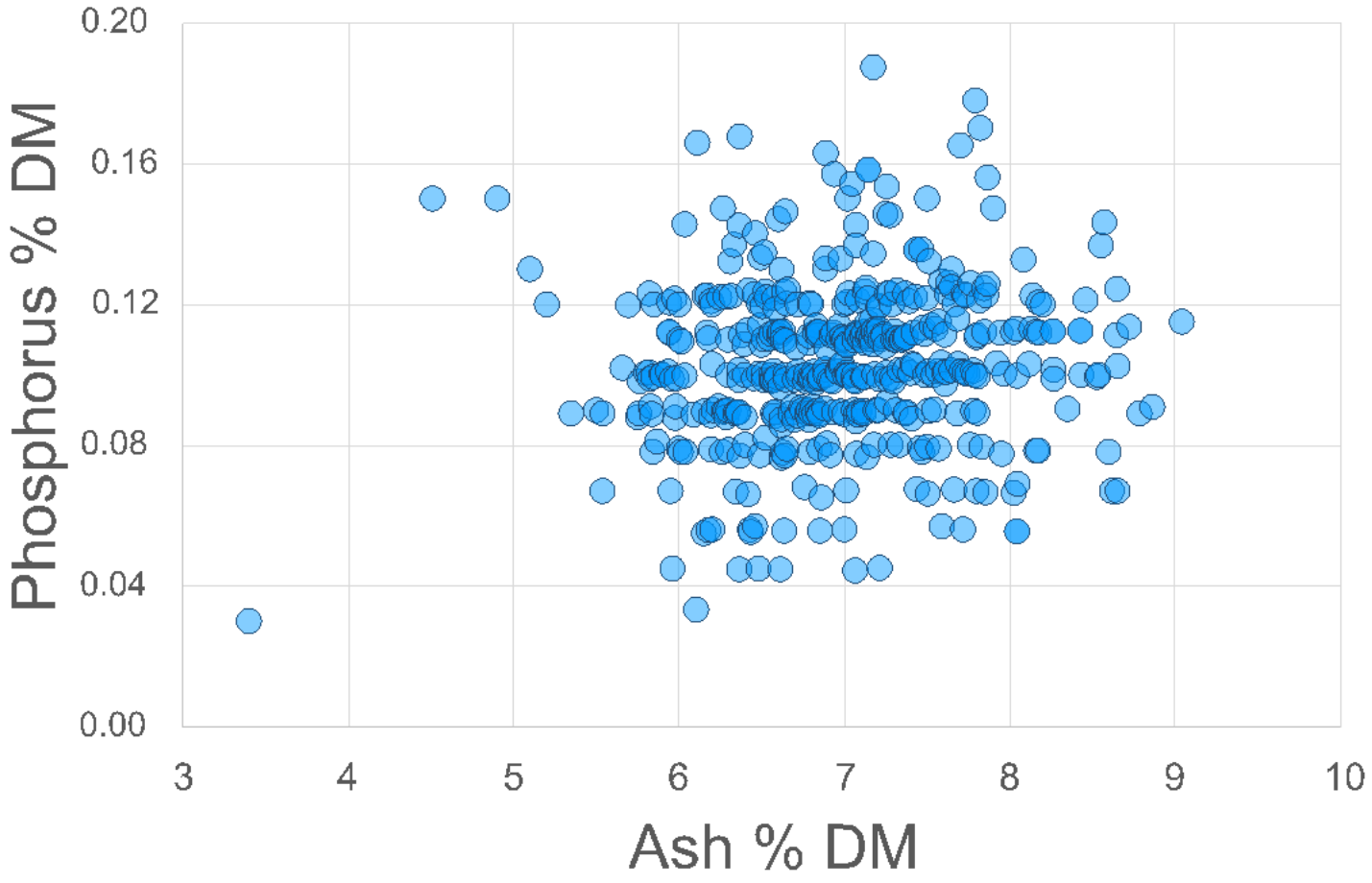
- Part of the normal range of values
- Abnormal but biologically correct values, caused by an unknown factor
- Analytical errors, typos, unit error…



The challenge of variability

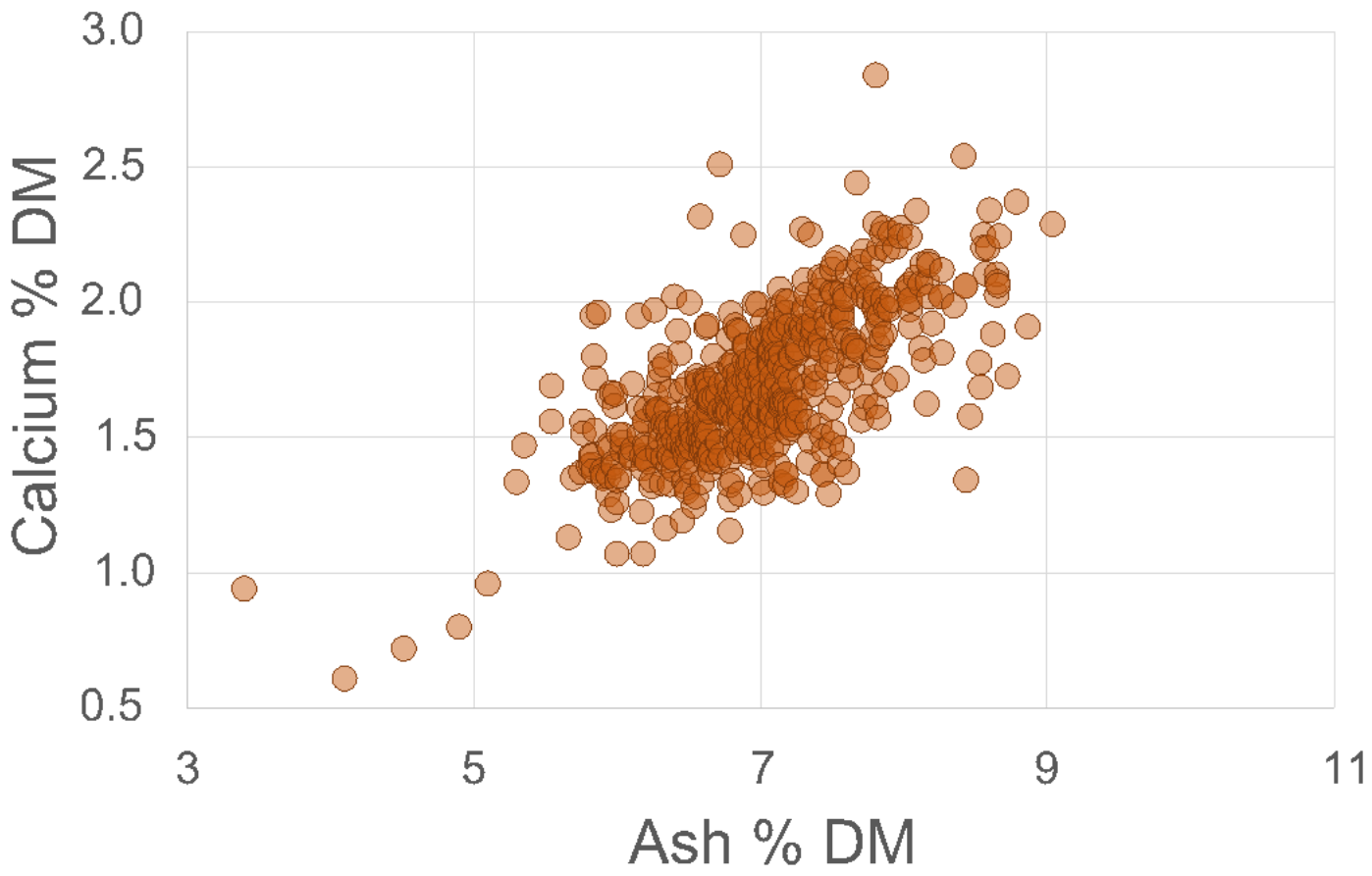
Usually, relations are poor between ash and minerals.

Dried citrus pulp: ash vs phosphorus



The challenge of variability

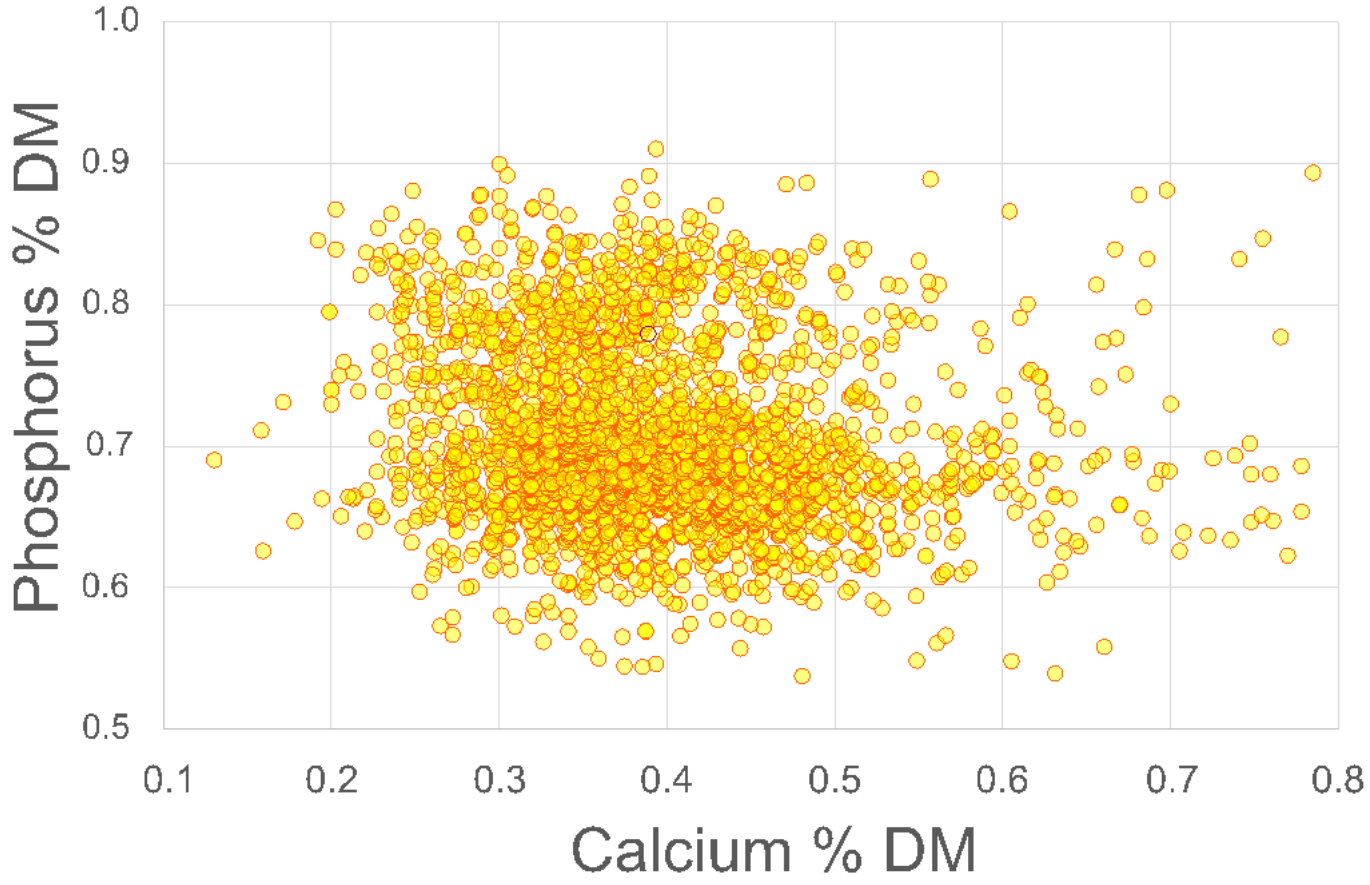
In the case of dried citrus pulp, there is a good relation between Ca and ash, due to the use of calcium salts in the drying process.



The challenge of variability

... and relationships are often poor between minerals.

Soybean meal: calcium vs phosphorus



Challenge N°2

Knowledge about mineral variability remains insufficient

We know less about minerals in feed materials than we think…

- Variability of minerals can be large
- It is poorly controlled and assessed, and then only for some major feeds and major minerals
- Again, there is a global lack of knowledge on the assessment of the mineral value of lesser feeds and of trace minerals

Faster, cheaper methods of analysis able to provide full mineral profiles in routine, for a better coverage of the mineral value of both conventional and non-conventional feeds.

Thank you for your attention!