



**Reliable analysis of animal feeds -
The importance of proficiency testing**

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Analysis of Animal Feeds

- Background
- Legislation
 - EC Regulation 183/2005 (and feed related aspects of Regulation 178/2002).
- The importance of testing
 - Welfare, legislation and profitability
- The importance of getting it right!
 - Using the right method
 - Monitoring quality
- How can PT help?



Animal Feeds

- Animal feeds are vital for the production of livestock and livestock products.
- Covering produced feeds, forages and supplements etc., a huge number of materials are available.
- Information regarding both the quality of the feed and the presence of contaminants is vital.
- Contamination can arise from a wide array of sources, both 'natural' and 'man-made'.

The Animal Feed Market

- Total feed market £200 billion?
- World production of 548 million tonnes per annum
 - Europe 199 million tonnes
 - USA 160 million tonnes
 - Asia 132 million tonnes
 - ROW 57 million tonnes
- Direct impact on farm profitability
 - Feeds often marketed with claims for faster growth
 - Earlier slaughter, earlier realisation of investment
 - 50% EU agricultural output is animal production
 - EU compound feed industry worth £50 billion per annum

Animal Feed Regulation

- Highly regulated (more than human food?)
 - EU views protection of animal health as a key way of protecting of public health
 - Regulation (EC) No 767/2009 controls the marketing, sale, nutritional labelling and permitted additives
 - Council Directive 2002/32/EC on undesirable substances in animal feeds
 - Numerous ISO Standards are published for the analysis of animal feed in analytical chemistry and microbiology



Animal Feed Regulation

- Feed Contaminants
 - The legislation, enacts regulation on;
 - “..all feed businesses, at all stages of feed production..”
 - “..relating to the feeding of food producing animals..”
 - “..including imports and exports to and from third countries..”
- The Regulation
 - Requires complete traceability of feeds, personnel and additives etc.
 - Obliges measures to be taken for the control of hazardous contaminants (mycotoxins, heavy metals, radioisotopes etc.) and zoonoses/zoonotic agents.

Animal Feed Regulation

- Feed Contaminants
 - Lists of ‘undesirable substances’ for feeds in the EU are;
 - **2002/32/EC and the subsequent amendments:**
 - **2003/57/EC and:**
 - **2003/100/EC etc.**
 - ‘Substances’ listed include;
 - As, Pb, F, NO₂, Cd, aflatoxin B₁, hydrocyanic acid, OC pesticides, dioxins, free gossypol, theobromine, volatile mustard oil, ergot, castor oil plant, other seeds and fruit (e.g. mustard, apricots, bitter almond).
 - Allowable limits for various feed types are also included.
- Feed Quality
 - According to Regulation 178/2002, feeds for sale in the EU must have declarations for the composition of;
 - Oils, fat, fibre, ash, lysine, tryptophan, energy, starch, total sugars, protein, calcium, phosphorous etc.

Recent contamination issues

- Large scale livestock issues
- Dioxins
 - **December 2008**
 - Dioxins were detected in Irish produce.
 - **January 2006**
 - Dioxin contamination reported by the Netherlands, on pig fat originating from Belgium.
- PCBs
 - **May 1999**
 - 200+ Belgian farms placed under surveillance after the discovery of high levels of toxic polychlorinated biphenyls (PCBs) in animal feed.

Other Animal Feed Issues

- Regular notifications on animal feeds and related products
 - <https://webgate.ec.europa.eu/rasff-window/portal/>
 - Including: Aflatoxin B1 in bird feed, maize and groundnuts,
 - Unauthorised GM materials,
 - Cadmium in fish meal,
 - Copper in chicken feed and,
 - Salmonella in fish feed, rapeseed meal, soybean meal etc.

PT and the quality of analysis

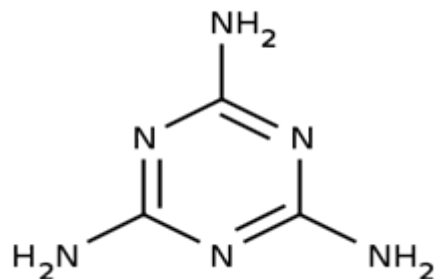
- Analytical performance
 - A large number of laboratories exist for the analysis of animal feeds
 - Many commonly used methods are empirical, such as fibre determinations, ether extract, in-vitro digestibility etc.
 - In-house methods and method modifications are common
- Proficiency Testing
 - Proficiency Testing is applicable to both chemical and microbiological analysis
 - The use of 'routine' methods is encouraged by PT providers
 - Where available, participants report the uncertainty of their results and this is also assessed

PT and the quality of analysis

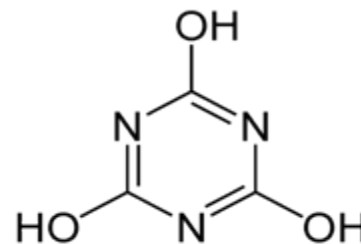
- Existing PT schemes
 - Several commercial PT schemes are run in this area of analysis
 - The International Measurement Evaluation Programme (IMEP) have run exercises (2008/2009) for the determination of trace elements in animal feeds
- Participant performance
 - ‘Pass rate’ or Satisfactory Z-scores is approximately 80%
 - Variations in performance were observed according to the analyte of interest and the sample concentration
 - Inclusion of laboratory uncertainty (zeta-scores) significantly reduces the percentage of satisfactory results

Which method are you using?

- Melamine and Cyanuric Acid in feeds
 - **December 2008**
 - Both compounds individually have low-toxicity, but when administered together may lead to kidney damage.



Melamine



Cyanuric acid

- Melamine has a very high nitrogen content
 - N = 66.63%, C = 28.57%, H = 4.79%

Melamine and Cyanuric acid

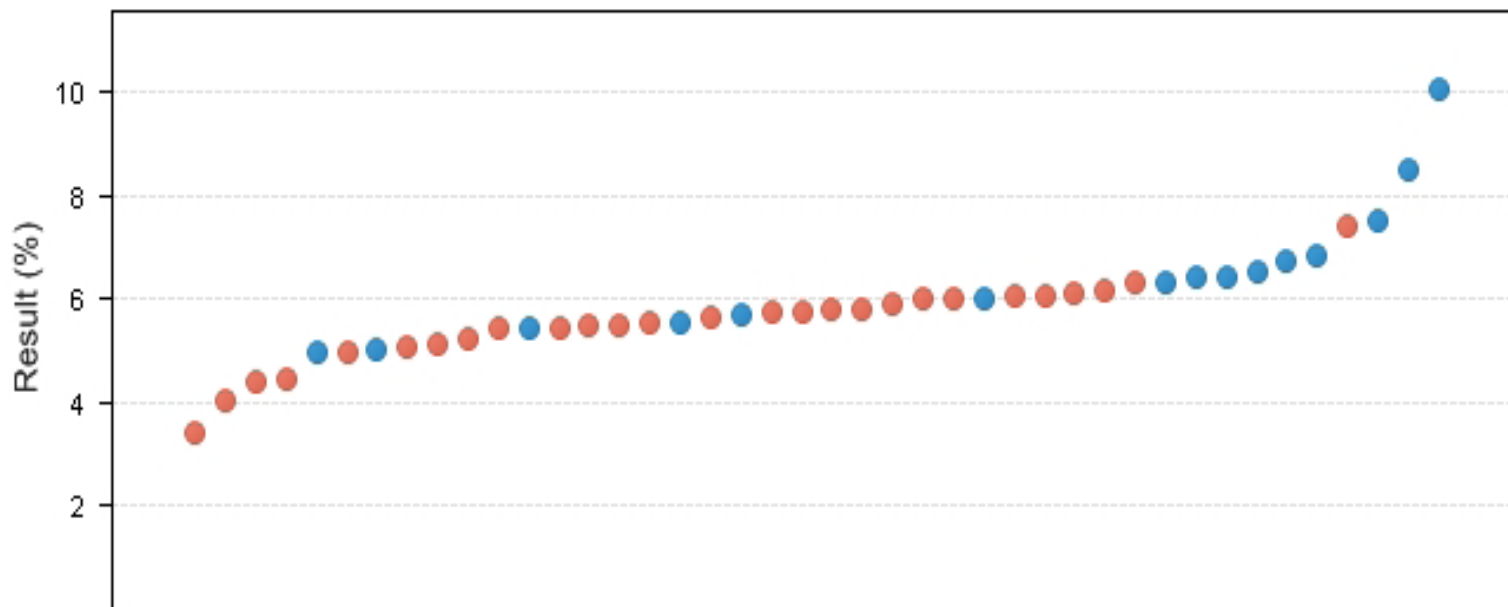


Excellence through measurement

- Historically protein content is determined by multiplying the Nitrogen content by 6.25
- Traditional methods for determining the nitrogen content do not identify the source of the nitrogen
 - Nitrogen may be from protein, other organic, or inorganic sources
- Addition of melamine to animal feeds greatly increases the 'apparent' nitrogen when analysis is carried out using traditional methods
- Methods of analysis for melamine have rapidly been developed
 - GC-MS, LC-MS/MS, ELISA (for screening and quantitation)

Method based reporting in PT

Distribution Graph



● Method A

● Method B

Method based reporting in PT

Statistic	2:1 Liquid/Solid	5:1 Liquid/Solid	Other
Results	22	10	1
Median	1.38	3.59	5.21
Robust SD	0.55	0.90	-
Uncertainty	0.16	0.38	-
SDPA	0.21	0.54	0.78
% Satisfactory	57.9	55.6	100

Benefits of PT

- Independent assessment of measurement quality!
- Enables laboratories to demonstrate competence with respect to regulatory standards
- Evaluation against critical decision levels
 - By carefully selecting analyte concentration levels PT providers can provide samples which are indicative of real world issues
 - Analyse lab performance at important concentration levels
 - Help participants to estimate uncertainty appropriately
- Interpretation of analytical data
 - Paper exercises and evaluation of supplied data and case histories

Benefits of PT

- Training and education
 - PT is an opportunity for improvement!
 - Provides valuable feedback on laboratory performance and can be used as a training tool for laboratory personnel
 - Participants can gain important information from both satisfactory and unsatisfactory performance
- Method validation
 - PT is a mechanism for the comparison of measurements with other labs using similar techniques in related industries
 - PT can enable the evaluation of methods and instrumentation as participant laboratories can report results for multiple analysts and for multiple methods

Multiple result reporting

Individual Lab report for the determination of Protein

Analyst	Method	Number	Result	Z-score	Units	Assigned Value	Robust SD
D1	IR	9	3.20	1.00	%	3.16	0.07
AL	Other	4	3.21	1.25	%	3.16	0.02
CH	IR	9	3.19	0.75	%	3.16	0.07
D2	Other	4	3.20	1.00	%	3.16	0.02
JM	Other	4	3.19	0.75	%	3.16	0.02
ND	Other	4	3.22	1.50	%	3.16	0.02
PMcM	Other	4	3.19	0.75	%	3.16	0.02
RL	IR	9	3.20	1.00	%	3.16	0.07
RM	Other	4	3.19	0.75	%	3.16	0.02
SA	Other	4	3.23	1.75	%	3.16	0.02
SRA	IR	9	3.16	0.00	%	3.16	0.07

Qualitative and semi-quantitative testing

- Many analytical tests are carried out to screen products or raw materials
- Methods may be qualitative:
 - Analytes, such as organic contaminants, antibiotics or pathogenic micro-organisms, are screened according to their presence or absence in a sample.
- Or semi-quantitative:
 - Tests are not as accurate or precise as traditional analysis (HPLC, GC etc.) but a numerical result can be obtained
 - Screening tests for the analysis of mycotoxins, where ELISA and Lateral Flow (Charm, Neogen) methods are increasingly used

Qualitative and semi-quantitative testing

Analyte: Antibiotics

Lab ID	Method	Result
CH2676	Betastar	Positive/Fail
CH2771	Betastar	Positive/Fail
CH2779	Charm	Negative/Pass
CH2786	Other	Positive/Fail
CH2791	Betastar	Positive/Fail
CH2799	Betastar	Positive/Fail
CH2882	Charm	Positive/Fail

Data Statistics

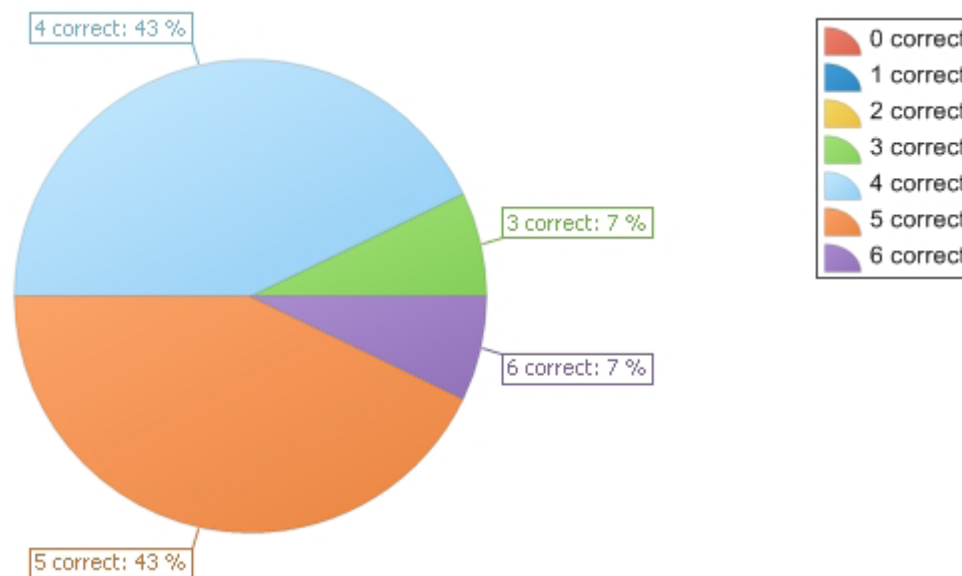
	Result
Assigned Value	Positive/Fail
Number of Results	53
Satisfactory	86%

Methodology Summary

	Result
Betastar	100%
Charm	82%
Delvotest/Delvotest P	100%
Delvotest SP-NT	100%
IDEXX Snap Beta-Lactam	100%
Other	100%

Qualitative and semi-quantitative testing

Analyte: Qualitative determination of organic components



Methodology Summary

Method	Unknown 1	Unknown 2	Unknown 3	Unknown 4	Unknown 5	Unknown 6
Various	71%	100%	79%	86%	100%	14%

LGC Standards AFPS Scheme

- Samples and matrices provided for 2010/11

Sample Type	2010/11 Matrices
Sample 1: Proximate analysis	Broiler feed, Maize, Coconut extract, Pig feed
Sample 2: Minerals and Trace Elements	Pig feed, Premix minerals, Broiler feed, Calf milk replacer
Sample 3: Fat quality	Coconut oil, Lard, Rapeseed oil, Soybean oil
Sample 4: PCBs and Organochlorine compounds	Rapeseed oil, Coconut oil
Sample 5: Mycotoxins	Cattle feed, Peanut extract
Samples 6 + 7: Microbiology	Simulated animal feed

Thank-you for listening

