



# **UK GRAIN TESTING NETWORK MEMBERS HANDBOOK**



# UK GRAIN TESTING NETWORK MEMBERS HANDBOOK

## Significant revisions for this edition

Page	Location	Change
	Each page	Version number altered to 1.3
	Various	Alteration to update name of 'Sciantec'
3	1 <sup>st</sup> paragraph	Update of current membership numbers
3	List of equipment	Addition of Foss DA1650 in list of equipment with full membership
3	Final paragraph	Note regarding potential payment in advance for serial late payers
5	List of equipment	Addition of DA1650
6	First paragraph	Note regarding charge for replacement standardisation samples
6	Final paragraph	Information regarding reference methods for bean analysis
10	List of analysis	Alteration to record SW as 'standard' analysis within barley and wheat ring checks
10	4 <sup>th</sup> paragraph	Addition regarding monitoring of reference lab data at committee meetings

# **UK GRAIN TESTING NETWORK MEMBERS HANDBOOK**

This handbook provides information on various aspects of the Network and how it operates. It is intended to be a resource which members should consult if they have any queries regarding the Network. If the answer cannot be found in the Handbook, contact the Network Technical Administrator or the relevant Steering Committee Member listed on page 17.

If you would like the handbook expanded, clarified in places or new topics covered, please contact the Network Technical Administrator.

## **Contents**

What is the Network?	Page 1
Membership	Page 3
Network operation	Page 5
Some statistics and precision data	Page 7
Ring checks	Page 10
Communication, contacts and problems	Page 16



## What is the Network?

The UK Grain Testing Network is a group for people involved with the analysis of grain (barley, wheat, oilseed rape, oats and field beans) who have the common objectives of achieving the best possible accurate results from their instruments and reducing the disagreement between analytical results within the grain industry. The Network provides a cost-effective tool to help achieve this.

Membership also indicates to others that a company is following a certain regime regarding analytical testing and instrument calibration. If the Network become aware that any member is not following the appropriate procedures this will be indicated on the membership list available via the website so that others can be made aware of the situation.

The Network is a user-group and exists for the members. It is not part of a company, but contracts required work to appropriate organisations. The Network works closely with instrument suppliers as certain tasks can only be achieved by the facilities and technology they offer in support of their instruments. The Network charges an annual membership fee but does not aim to make a profit.

### **Aims and objectives**

- For all full members, instruments will be standardised to a common reference point just prior to harvest.
- Working with, and providing data to instrument suppliers to update calibrations on an annual basis to incorporate newer varieties and enhance robustness and accuracy.
- The calibration performance during harvest will be monitored and if required, updates will be made to all relevant instruments (via the suppliers) during harvest.
- Monitoring of the master calibrations and collaborating with instrument suppliers if any investigational work is required due to deterioration in performance.
- Providing ring check samples on a regular basis to allow members to compare their instrument performance with that of others and reference analysis.
- The Network supplies a service that will help reduce disagreements in analytical results throughout the grain industry and encourages good laboratory practices by using common samples and sharing data in a cost-effective manner.
- To have a system whereby membership indicates to others that certain standards are being met for grain analysis.

### **Responsibilities and liabilities**

- The Network is **not** responsible for the precision and accuracy of calibrations. The master calibrations are owned, maintained and developed by the instrument suppliers.
- The Network assesses the master NIR calibrations on sub-master instruments. The commodities and constituents involved are Barley (total nitrogen and moisture), Wheat (protein and moisture), Oilseed Rape (oil and moisture (and Erucic Acid on DA 1650 only)) and Oats (protein and moisture). The Network does not currently assess any calibrations for other commodities (e.g. rye, peas, beans) or analytes (e.g. alcohol yield, ergosterol, colour etc.). Members are entirely responsible for the monitoring of these additional “in-house” calibrations themselves. In addition to the above NIR results, the measurements of specific weight for barley, wheat and oats are also assessed.
- The Network is **not** responsible for monitoring the day to day precision of the individual user’s NIR instruments in the UK Grain Testing Network and does not monitor members’ instruments in any way.

- Members are responsible for reading the Network ring check reports, monitoring the precision of their own instrument, and conducting any investigations or corrective action relating to their own instrument. If adjustments to any Network calibrations is required, this must be done in conjunction with the Network. Instrument suppliers for full member instruments will not adjust network calibrations on any instrument without authorisation from the Network Technical Administrator. An instruction on how to request a change to a calibration is given in the Procedure for Adjustment to Network Machine document (this can be found on the Network website).
- The Network will provide a list of all members via its website which will be updated monthly. This list will not link member name with Network Number so individual members cannot be linked to individual results on the ring check reports. However, if the Network are provided with information indicating that an instrument is not standardised, has old calibrations or is using non-standard calibrations this will be indicated in the list. This is to indicate to others that the company/site whilst a Network member, is not working to the current Network standards. The Network will endeavour to ensure this information is correct and will not be liable for any consequences of the listing. Members should inform the Technical Administrator immediately if they think their listing is incorrect.
- Members are advised to run daily IQC control check samples and join additional ring check schemes where appropriate. The TASCC Code of Practice for Testing Facilities of Combinable Crops will provide guidance.
- Members are requested to inform instrument suppliers and the Network Technical Administrator immediately if they suspect any problems with their instrument's calibrations.
- Reasonable measures will be taken to inform instrument owners of communication sessions, to pick up calibration scans or download calibration adjustments. However, the instrument user must ensure that their equipment is connected to the internet during these contacts. Members can find the latest NIR calibration codes via web pages, reference to the monthly ring check reports or by contacting the Network administrator or instrument suppliers.
- **Every analysis will have an associated analytical error.**  
NIR is a secondary predictive method. There will always be a finite prediction error which will vary in magnitude. Members must be aware of and familiarise themselves with the typical analytical errors associated with the reference methods and the NIR predictions.
- Mouldy grain, pre-germinated grains, immature grains, excessive foreign seed etc. may increase analytical errors. Oilseed rape calibrations are particularly affected by the presence of high erucic acid type seeds.
- The Network is a membership-based user group, run by a Steering Committee drawn from the membership. **The Network, its Steering Committee and Technical Administrator, cannot be held liable for any financial or commercial losses arising from its services.**
- For users with NIR models not eligible for Full Membership they must liaise with their instrument suppliers for any pre-harvest standardisation, harvest bias monitoring and any post-harvest bias adjustments.

## **Membership**

There are 277 members in the Network (as of December 2021) in locations over a large part of the UK, ranging from Cornwall to Easter Ross, East Anglia to Merseyside and Northern Ireland. The membership has grown each year since the Network started but is still relatively small compared to some Networks in Europe and other parts of the world. The companies involved include plant breeders, grain merchants, farmer's co-operatives, grain exporters, flour millers, maltsters, brewers, distillers, oilseed crushers and research organisations.

There are two types of membership.

**Full membership** involves having an NIR instrument which can participate fully in the Network. These instruments are currently limited to:

- Foss Infratec 1241, Infratec Nova and 'Infratec'
- Foss DA1650 (for erucic acid)
- Perten Inframatic 9500
- Infracont X-Grain and S-Grain

Most members have full membership and access to all the benefits of standardisation, calibration monitoring and ring check provision that the Network provides.

**Ring Check Only** participation is offered to others that do not have the appropriate instruments for full membership, or don't wish to have full membership. Any requirements for standardisation, calibration updates or harvest assessments will have to be made directly with the instrument supplier or agent. Ring Check Only participation accounts for around 10 – 15% of total membership.

Since 2018 there has also been membership offered for ring checks in mycotoxins. This is a ring check only service for which users can use their chosen analytical method.

Since 2018 there has also been a ring check for erucic acid in OSR and in 2019 the network began to support standardisation and calibration monitoring for Erucic Acid in Foss DA1650 analysers.

Starting from harvest 2020 the Network also offers a ring check for moisture in field beans.

Subscription renewal notices are usually sent to all existing members in March and need to be returned before the end of April so that appropriate numbers of samples can be prepared for standardisation that starts in May.

Subscriptions are paid annually (per crop year) by invoice, normally in June which is the start of the Network year (1 June to 31 May). Invoices will be on Network documents, but the accounts will be run by Cawood Scientific, Coopers Bridge, Braziers Lane, Bracknell RG42 6NS.

Members are advised that invoices must be paid within 90 days of issue. The Network reserves the right to suspend membership if payment is not received within 90 days. Suspension may involve: Ceasing to supply Ring Check Samples, removing your ability to access the PT Portal, ceasing to supply new, or removing existing, calibration bias updates and asking suppliers to remove network calibrations from your instrument. The Network also holds the right to request payment in advance for serial late payers.

The Network can only function if member companies supply various grain samples that are required during the year (e.g. 160 ring check and standardisation samples (each of 70-120 kg) and about 500 harvest monitoring 1 kg samples).

Please note that in becoming a Full Member of the Network you agree to the Technical Administrator having remote access to your equipment via the relevant supplier's communication software. This is to allow the Administrator to monitor such things as calibration and standardisation status and is not access for looking at any other data. Full confidentiality is assured and can be discussed (if you have any concerns) by telephoning the Technical Administrator on 0333 301 1241. The Technical Administrator, along with the rest of the Committee, has signed a confidentiality agreement.

## **Steering Committee**

The Network is run by a Steering Committee which determines how the Network functions, including making decisions about calibration bias adjustments. The committee is composed of about a dozen members who represent various sectors of the grain trade and have a geographical spread through the UK. The committee select contractors to carry out the various tasks (e.g. reference analysis, sample preparation and distribution, technical and administrative support) required to run the Network. Names of committee members and other contacts are given on page 17. Instrument suppliers are invited to committee meetings as appropriate.

## **History**

The Network began in 1994 with three companies (Allied Grain Ltd., Glencore Grain (UK) Ltd. and Carlsberg-Tetley Ltd. - two grain traders and a maltster) and 12 instruments. At that time there were only wheat and barley calibrations (no oilseed rape or oats) and no monthly ring check samples. Despite the lower level of facilities, the subscription was £2,000; double that of 16 years later. Another change has been the name. The "UK Infratec Network" changed its name for harvest 2002 to the "UK NIR Grain Network". The reasons for the change were to show independence from any individual instrument supplier. About the same time membership became open to those only wanting to participate in the ring checks, and the Network became one of the biggest proficiency testing schemes in the UK. In 2017 there was another name change to "UK Grain Testing Network" which opened the doors for the network to become involved in other grain testing technologies in addition to NIR; for example, mycotoxins in grains and erucic acid in OSR.

# Network Operation

## Calibrations

For full members the calibrations used in instruments are supplied by, and are the responsibility of the instrument supplier / manufacturer. The supplier / manufacturers own the master calibrations and are responsible for their ongoing upgrading and precision.

Any calibration adjustments, as requested by the Network, are loaded onto individual NIR instruments by the equipment manufacturers. The Technical Administrator will instruct Sciantec to e-mail the relevant users that a calibration adjustment download is due. The download will normally be carried out overnight, and the success of these downloads will be monitored on a shared spreadsheet by the equipment suppliers, the Technical Administrator and Sciantec.

The current calibrations in use can be found at the following websites for each appropriate equipment supplier –

Foss                    <https://fossanalytics.com/en-gb/knowledge/ukqn>

Perten                <https://www.perten.com/im9500/ukgnir>

Infracont            <https://www.infracont.com/en/ukqtn>

The current equipment, supported as full members, is as follows –

Foss                    1241, Nova and Infratec (if network connected), and DA1650

Perten                9500

Infracont            X-Grain and S-Grain

## Other instruments

The Network do not currently support calibrations for any other instrument types or instrumentation from any other manufacturers, including those used by members signed up for “Ring Check Only”. The Network works with other instrument manufacturers from time to time to help assess their equipment and calibrations and may decide to add equipment and calibrations to the list of those supported for ‘Full Membership’ following review of the data by the committee.

## Standardisation

Prior to each harvest all Network full members instruments are standardised (at the same time) using sets of appropriate samples. This involves comparing results, (using the latest calibrations) from individual members’ instruments to those of the sub-master NIR (the reference NIR instrument for the Network) and with the whole population of UK Instruments. At the same time, the sub-master results will be compared with the reference chemical analyses for the standardisation sets. Instruments are then individually adjusted for any bias to bring them into agreement with the appropriate sub-master NIR instrument (appropriate calibrations are also downloaded at the same time). Ideally all instruments will have been serviced prior to standardisation (this is outside the scope of the Network).

**PLEASE NOTE - Members should keep the standardisation samples, suitably packaged, and stored, as they may be needed again in the event of having instrument problems.**

**If a member requires a replacement set of standardisation samples there will be a cost involved, and these will be invoiced for at the time of ordering.**

## **Harvest Master Calibration Assessment**

During the harvest period, new crop grain samples are collected from Network members around the country (approximately 200 Barley, 100 Wheat, 200 OSR, 100 Oat). These are sent to the appropriate reference laboratory where they are analysed using the appropriate NIR sub-masters and by reference methods. For barley, which has a more sensitive and less robust calibration than wheat, in addition to the above samples, several members with NIR instruments and reference methodology voluntarily supply additional data via the "Barley Workbook". The workbook typically contains between 1000 and 1500 samples. The Network committee carefully controls how these data are produced and used. All these samples are used to assess the calibration performance with new crop grain. The Network steering committee and those providing technical support, monitor the calibration assessment data and will decide if any calibration bias adjustments are required based on these new harvest samples. These bias adjustments are then transferred to individual instruments as described above. The Steering Committee will also review the precision of the calibrations and warn the equipment suppliers if the precision declines.

## **Reference Analytical Methodology**

These methods, as agreed by the Network Committee are as follows:

### **Barley and Wheat**

- **Moisture** for wheat and barley ISO 712:2009 (oven 130°C for 2 hours).  
The UK cereals industry adopted this standard for Harvest 2011 onwards. Under this standard, any sample with a moisture content of greater than 15% will be analysed using the double drying method.
- **Nitrogen / Protein (N x 5.7)** for barley and wheat respectively, the Dumas combustion technique using the reference laboratories in-house method which is equivalent to the Campden BRI CCAT Method No. 19.
- **Test Weight** for wheat and barley determined using a Chondrometer calibrated according to BS EN ISO 7971-2:2009.

### **Oilseed Rape**

- **Moisture** for oilseed rape ISO 665:2000 / BS 4289-3: 2000 (oven 103°C for 3 hours).
- **Oil** for OSR uses a method based on BS EN ISO 10565:1998 – Oilseeds, which uses a nuclear magnetic resonance spectrometry (NMR) method. The NMR is subject to cross checks using BS EN ISO 659:2009 - Determination of oil content by triple solvent extraction.

### **Oats**

- **Moisture** ISO 712:2009 (oven 130°C for 2 hours).
- **Test Weight** determined using a Chondrometer calibrated according to BS EN ISO 7971-2:2009.
- **Protein (N x 6.25)** the Dumas combustion technique using the reference laboratories in-house method which is equivalent to the Campden BRI CCAT Method No. 19.

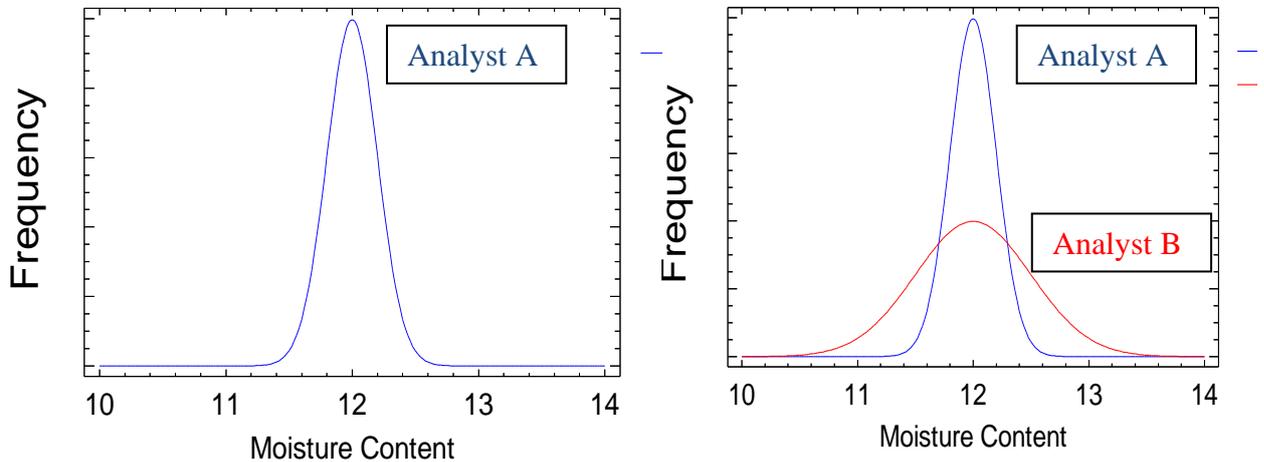
### **Beans**

- **Moisture** ISO 24557:2009 (air-oven method).
- **Protein (N x 6.25)** the Dumas combustion technique based upon ISO 16634-2:2016

# Some Statistics and Precision Data

## The Normal Distribution and Standard Deviations

Analyst A repeats the same analysis (e.g. an oven moisture determination) on a sample one thousand times and gets a range of results. Analyst B also analyses the same sample one thousand times. We graph the results below:



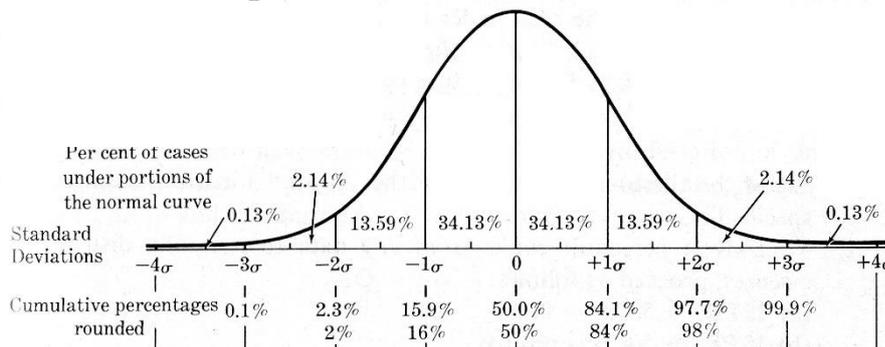
Analyst A (blue line) gets a mean value of 12% moisture, while analyst B (red line) also gets an average of 12% moisture but a bigger spread of results. Many sets of analytical results show the typical normal distribution curves above. We use the term “standard deviation” (frequently denoted by the symbol  $s$  or  $\sigma$ ) to describe the spread of the results around the mean in a normal distribution. The standard deviation is :

Standard deviation =  $\sigma = s = \sqrt{\frac{\sum_{i=1}^n (x_i - \bar{x})^2}{n - 1}}$

Sample

Where  $\bar{x}$  is the sample mean,  $x_i$  the individual observation and  $n$  the number of samples.

In the graphs above Analyst A has a standard deviation of 0.2% and Analyst B 0.4%. The areas under the normal curve are given below:



Areas Under a Normal Curve

If results are distributed normally, then 68.26 % of the values will lie in the range mean  $\pm$  1.0 standard deviations, 95.4% in the range mean  $\pm$  2.0 standard deviations and 99.7% of the values will lie in the range mean  $\pm$  3.0 standard deviations.

## Repeatability and Reproducibility

It is important to know how accurate and precise a method and a laboratory's results are. Repeatability is a measure of the spread of results within a laboratory and the reproducibility the spread of results between laboratories. Samples may be distributed by organisations in special trials (normally according to ISO protocols) to determine the repeatability and reproducibility of various laboratory methods. The following statistics are often used:

The **repeatability standard deviation**  $s_r$  or  $\sigma_r$  is generally applied to the results obtained using the same method and same material under the same conditions (same operator, apparatus and laboratory) This is the within laboratory variation.

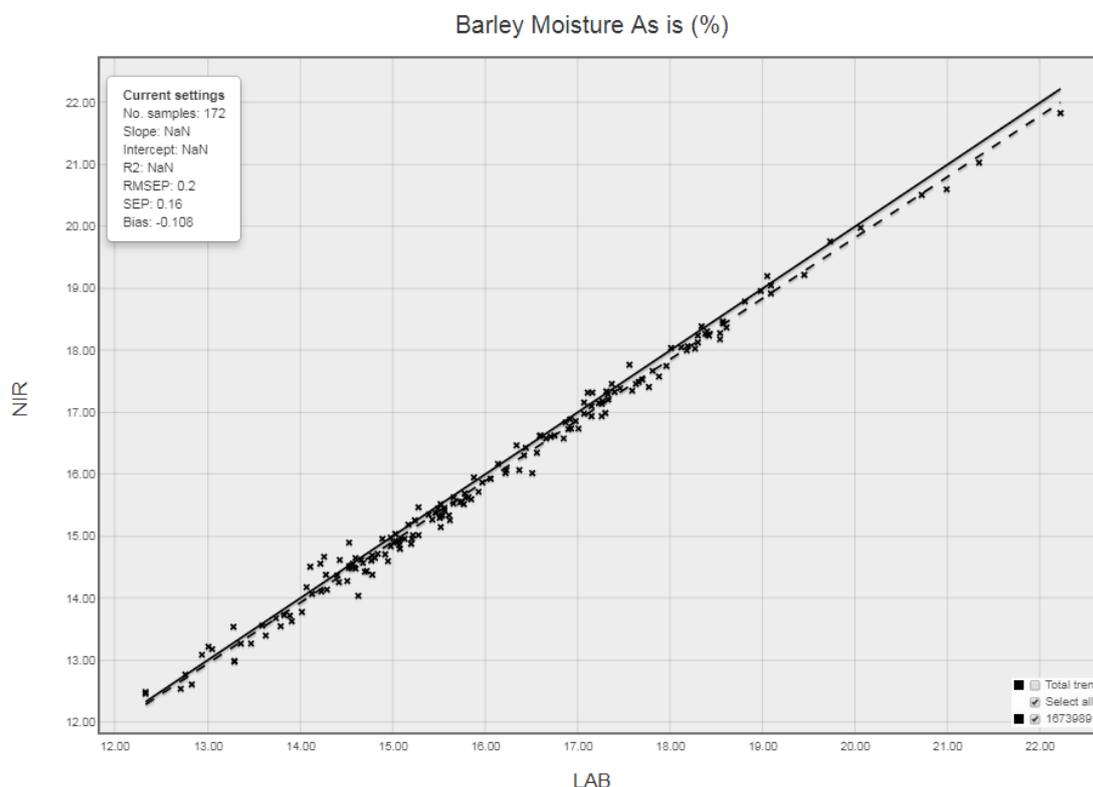
The **reproducibility standard deviation**  $s_R$  applies to the results obtained using the same method and material in different laboratories (different operators, different apparatus and laboratories) This is the total variation and is calculated by combining the between-laboratory variance, the sample/laboratory interaction and the within-laboratory variance.

The **repeatability limit**  $r_{95}$  The absolute difference between two independent single test results, obtained with the same method on identical test material in the same laboratory by the same operator using the same equipment within a short interval of time shall not be greater than the values of  $r_{95}$  in more than 5% of cases.

The **reproducibility limit**  $R_{95}$  The absolute difference between two single test results, obtained with the same method on identical test material in different laboratories by different operators using different equipment will not be greater than the values of  $R_{95}$  in more than 5% of cases.

## Regression Analysis

When using NIR, the NIR predicted values are compared for the same samples analysed by the reference chemistry. When comparing the results, we obtain the typical graphs below.



Monitoring graph from Perten website for barley moisture – Harvest 2017

**The Standard Error of Prediction (SEP or SED)** is an expression of the bias corrected average difference between predicted and reference values predicted by a regression model when applied to a set of samples not included in the derivation of the model.

**The Root Mean Square Error of Prediction (RMSEP or RMSED)** is an expression of the average difference between reference values and those predicted by a regression model when applied to a set of samples not included in the derivation of the model. Note – RMSEP includes any bias in the predictions.

**The Bias** is difference between the mean reference value and the mean value predicted by the NIR model.

**The slope** of a regression line represents the amount Y increases for unit increase in X.

Typically when analyses are predicted by NIR, 95% of the predicted values will agree with the reference values to within  $\pm 2$  Standard Error of Predictions. Thus for the wheat moisture graph above, 95% of the moisture results predicted using the Infratec submaster would agree with the oven moisture values to within  $\pm 0.44$  %

**The median.** When data points are arranged in order of magnitude, the median is the central member of the series. There are equal numbers of samples great than this value and equal number of samples lower than this value.

## Reference Analytical Methodology - Precision

	ISO Standard	Repeatability Standard deviation	Repeatability Limit $r_{95}$	Reproducibility Standard deviation	Reproducibility Limit $R_{95}$
<b>Barley &amp; Wheat</b>					
Barley Moisture (%)	ISO 712:2009	0.04	0.11	0.17	0.47
Wheat Moisture (%)	ISO 712:2009	0.05	0.14	0.14	0.39
Barley Nitrogen (%db)	ISO 16634-2:2009	0.0139	0.04	0.039	0.11
Wheat Nitrogen (%db)	ISO 16634-2:2009	0.0101	0.03	0.040	0.11
Wheat Protein (%db)	ISO 16634-2:2009	0.0576	0.16	0.230	0.64
<b>Oilseed Rape</b>					
Moisture (% oven)	ISO665:2000	0.06	0.2	0.16	0.4
Moisture (% NMR)	ISO10565:1998	0.04	0.1	0.30	0.6
Oil (% Solvent extraction)	ISO659:2009	0.10	0.27	0.55	1.54
Oil by NMR (%)	ISO10565:1998	0.2	0.6	0.55	1.60

## Ring Checks

Sciantec administer the ring check schemes for the Network. Since February 2011 this proficiency testing scheme has been audited annually by PAI and Sciantec became accredited according to the requirements of Appendix 2 of the TASC Code of Practice for Testing Facilities of Combinable Crops. Monthly ring check samples are sent out to enable members to confirm the performance of their instruments throughout the year. It is the members' responsibility to read the ring check reports and, if necessary, investigate and initiate any corrective action required. The bulk samples supplied by Members for ring checks are normal, commercial samples that have been accepted for intake. The Network is careful **not** to select only perfect samples that predict well by NIR. The ring checks may highlight problems with the crop, e.g. contamination, pre-germination, unusual varieties etc. The Network does not issue instructions concerning how to present the ring check sample to the NIR. For example, some members may carefully pick out any foreign seed, other members may analyse the sample three times and take the mean to give a more exact value etc. The protocol used is left entirely the Member Laboratory.

### **Ring Check Timetable.**

- **Wheat:** four samples are sent out monthly (except June) for Moisture, Protein, SW and Falling Number.
- **Barley:** four samples are sent out monthly (except June) for Moisture, Nitrogen and SW.
- **Oilseed Rape:** three samples will be sent out for 6 months (typically July, Aug, Sept, Nov, Jan, and May for Oil and Moisture).
- **Oats:** three samples will be sent out for 6 months (typically Aug, Sept, Oct, Dec, Feb, April) for Protein, Moisture and Specific Weight.
- **Beans:** three samples will be sent out four times a year (Sept, Oct, Dec and Mar)
- **Mycotoxin:** three samples sent out three times a year (Jul, Dec, Mar)
- **Erucic acid in OSR:** four samples sent out three times a year (Jun, Jul, Nov)

Reports are produced via the UKGTN PT Portal and members have access to these as appropriate for their membership. These reports detail the performance of all participating instruments, including the sub master instruments.

### **Reference analyses.**

Except for Falling Number members' results are judged against reference analyses from several laboratories (Network reference lab and members' expert labs). Any member is welcome to apply to supply reference analyses provided the methodologies used are appropriate. If you are interested in supplying reference analyses, please contact the Technical Administrator. Member expert labs must be able to submit consistent, accurate and precise reference data on time and for all samples. Members will be reimbursed for consistent and accurate reference analysis, in the form of a rebate from their next subscription fee.

Reference analysis and reference lab performance will be monitored at the Spring and Autumn committee meetings.

### **Network reference laboratories**

The Network has two reference laboratories. Sciantec are the barley, wheat and oat reference laboratory. They have UKAS accreditation and meet the ISO 17025 accreditation standard. They supply the Network with analytical data as well as running the monthly ring check scheme. As part of the quality system they take part in a number of check schemes of which MAPS (malt analytes proficiency scheme) and NABIM (National Associate for British and Irish Millers) scheme are relevant to the analyses carried out for the Network.

Sharnbrook Grain acts as the reference laboratory for oilseed rape and they participate in the AIC TASCC schemes.

### **Naming participants and indicating their instrument status if non-standard**

From harvest 2015 lists of participating companies and sites will be given on the Network website. This is to clarify who has Network membership and hence should be working to a known set of standards.

If the Network have been made aware of members who do not have standardised instruments or do not have up to date Network calibrations, or have non-standard calibrations (e.g. with an adjustment not sanctioned by the Network) this will be indicated on the list. Whilst care will be taken in indicating use of non-standard calibrations the Network cannot guarantee that such information will always be correct. If members feel they have been listed incorrectly they should inform the Network technical administrator immediately. The Network cannot be held liable for any consequences from the listing.

### **Ring Check and Standardisation Samples**

Members supply the 100 kg barley and wheat, 75 kg OSR, 60 kg oat and 25kg beans samples. The Network needs 52 barley, 52 wheat, 28 OSR, 28 oat and 12 bean samples each year for ring checks, plus a further 24 10 kg samples OSR with elevated Erucic Acid levels. If you can help, please contact Sciantec or the Network Technical administrator. Sacks for filling and instructions will be sent out and Sciantec will arrange the pickup of these samples using a pre-paid courier.

Members supplying suitable samples receive a credit against subscriptions for the following year. The credit is reviewed annually by the Network Committee and will not be paid if the sacks supplied are underweight and cannot be used.

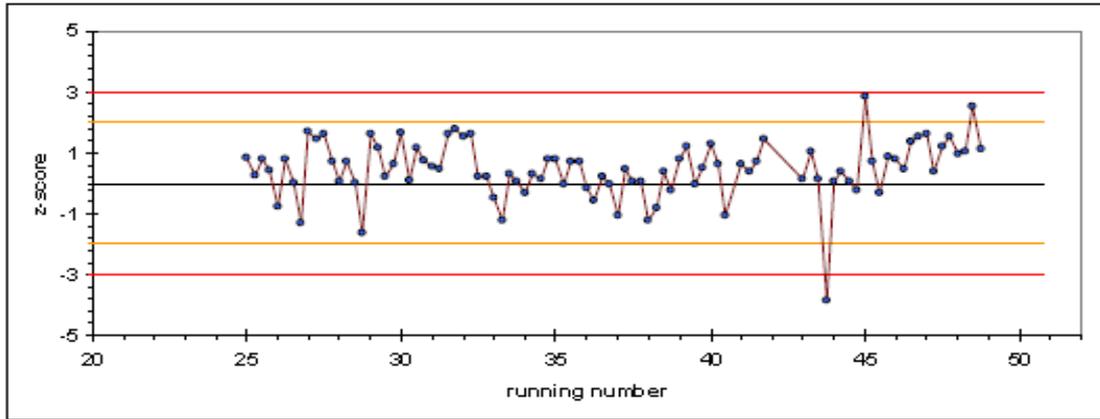
**It is extremely difficult to quickly obtain samples for the July ring checks each year. If you have access to appropriate early harvest samples, please contact the Network Administrator or Sciantec.**

### **Ring Checks Explained**

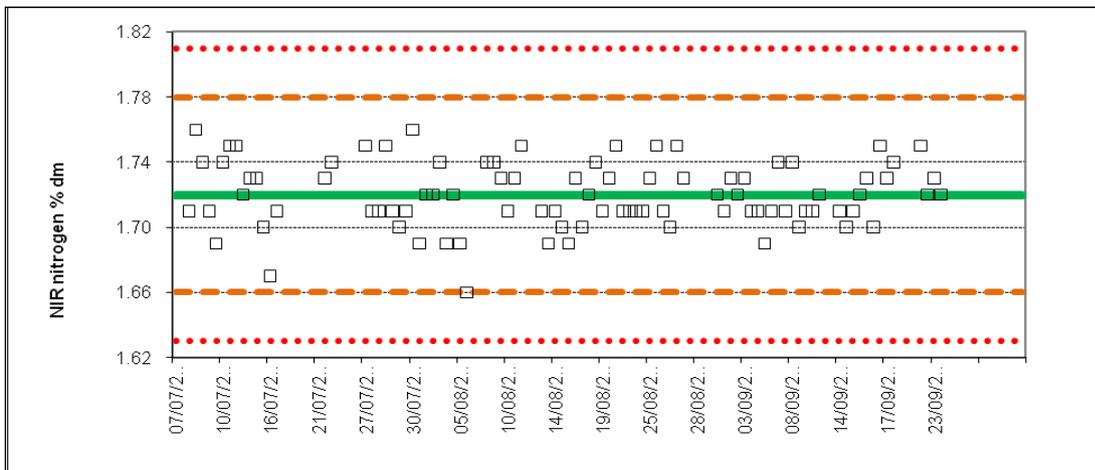
It is good laboratory practice, and essential in many codes of practice and quality standards (e.g. TASCC), to take part in appropriate ring check schemes. These provide a means to compare results between laboratories performing similar analyses and, in some instances, comparison of secondary method results (e.g. NIR) to those from reference methods. The aim is for individual laboratories to monitor the performance of their methods and know how they compare to others performing similar analyses. This can give confidence to the laboratory, and its customers, that results are reliable and any deterioration in performance can be detected and then remedied.

Sciantec, the Network reference laboratory, specifically take part in the MAPS (malt analytes proficiency scheme) run by LGC, to monitor the reference method results (barley oven moisture and Dumas nitrogen) and the NABIM (National Associate for British and Irish Millers) scheme (wheat oven moisture and Dumas protein) as well as the sub-master Infratec results.

Network Members are encouraged to run their own, in-house daily standard samples and plot results on a control chart (particularly during Harvest Intake). This will monitor the day to day precision and reliability of the instrument. A recent past ring check sample may be useful as the reference as the UK mean NIR values will be accurately known.



A daily control chart (IQC) using z-scores (Warning limit  $\pm 2$  z-score, Action limit  $\pm 3$ z-score).



A different daily control chart for barley nitrogen with mean of 1.72% dry base and Warning limits at  $\pm 0.06\%$  (1.66, 1.78) and Action limits at  $\pm 0.9 \%$  (1.63 and 1.81).

A Network check scheme is run so that members can compare the performance of their instrument against others in the Network and the sub master instruments and reference methods. In addition, instrument suppliers and the Network Committee can assess if the overall Network performance meets the expected standards.

Samples are distributed by the Network reference lab each month. These are cleaned, blended, split and distributed to Network members for analysis by NIR instruments. Some Network member laboratories also supply results by reference analyses. It is these reference results that members' results from NIR instruments are judged against.

The analyses from each participant are recorded via the UKGTN portal system.

<https://ukgn.sciantecportal.co.uk>

Each member requires to have at least one log in for this system, however depending upon requirements each member can have as many personal log ins as they wish. Please note that if a username does not log onto the system with a 12-month period that username is removed (after being advised so by the Network).

After the closing date for each round the report becomes available on the portal for members to view, save as an electronic copy or print. How to use the portal to view, save or print reports can be see in some online videos on the UKGTN website.

The report contains results of analyses from each instrument (these remain anonymous, except that each lab will know which sets of data are their own) plus results from the Network's spare instruments and the sub-master instruments at the reference labs which are used for calibration.

## Results

**Members are responsible for reading the ring check reports and initiating any investigations and corrective action required.**

All the results from each sample are listed and compared with an accepted value. How the accepted value is calculated varies depending on the grain type and the test. For moisture and nitrogen / protein for wheat and barley the robust mean of reference values is used (after the removal of outliers). This is the best option as it uses a consensus of reference results from several laboratories, an approach recommended by the HGCA Grain sampling and Analysis Project. When this approach is not possible individual results are judged against the robust mean of all submitted results (Falling Number). From April 2011, specific weight results are compared against the arithmetic mean of results generated using Chondrometers calibrated and certified in accordance with BS EN ISO 7971-2:2009. Each report indicates which accepted result is used to judge other results. To make results easier to interpret a system of z-scores is used (a widely used system in check sample schemes). This essentially classifies results into 1 of 3 categories; satisfactory, questionable and unacceptable, which easily indicates how well instruments are performing. With the Network check samples the criteria used for the barley z-scores are generally in line with or tighter than the AHDB recommendations and the criteria used by industry accepted check schemes. Each report states the criteria used to calculate z-scores. The Network periodically review historical ring check data, validate the standard deviations used to calculate ring check z-scores and compare the values with those given in the TASC Code of Practice for Testing Facilities for Combinable Crops – July 2010 – Appendix 3)

TASC Code of Practice Differences from accepted value Individual NIR Result compared with Reference Method				
	Barley		Wheat	
Z-score	Nitrogen % dm	Moisture %	Protein % dm	Moisture %
1.0	0.048	0.29	0.26	0.24
2.0	0.096	0.58	0.52	0.48
3.0	0.144	0.87	0.78	0.72

Example (barley):

	Accepted Reference value	Lab Infratec	Difference	z-score
Nitrogen % dm	1.60	1.54	-0.06	-1.25
Moisture %	14.2	14.9	0.7	2.4

A z-score between -2.0 and +2.0 is considered satisfactory, but if results are consistently close to +2.0 or -2.0 then the instrument may have a bias.

z-scores of -2.1 to -3.0 or +2.1 to +3.0 is generally considered questionable and extra monitoring may be advisable.

z-scores  $<-3.0$  or  $>3.0$  are considered unacceptable, especially if there are several, and indicates a potential problem with the instrument and/or its operation.

A single high z-score amongst mostly acceptable ones may well be due to a “one off” error of some sort and should not cause too much concern. In fact, 1 in 20 ‘normal’ z scores will statistically fall outside of  $-2.0$  to  $+2.0$ .

Sometimes it is unfortunately clear that when reporting their data, a Member has accidentally switched the data for moisture and protein (for example) or mixed up the samples during testing. Reports cannot be altered if these values are changed after the closing date. The Technical Administrator may at times contact a member, prior to the round closing, if it is felt that such an error has been made. This will allow the member to check and alter accordingly.

There are so many results in the Network Ring Check reports, often spreading over two pages, it can be difficult for individual labs to judge how they have performed in relation to all the other labs. To assist with making this judgement bar charts for results from each sample are included in the report. This lists samples by size of z-score so a lab, once their result has been located using the unique site number, can easily see if they tend to be in-line with most other labs or at one of the extremes.

Members can also use the trend function to assess their performance over time. There is also a video guide for this out the UKGTN website (see link above).

## Ring checks and Spare Instruments

If for any reason your normal instrument has failed and you are using a spare provided by one of the instrument manufacturers you will not be able to enter the monthly results into the PT Portal as you will only have access via the portal to your own instruments. In such cases you should enter any Falling Number and Chondrometer data against your own subscription via the portal as normal and then email the NIR results from the spare to [admin@ukgrain.org](mailto:admin@ukgrain.org)

The Network Technical administrator will then enter the NIR data for the spare.

### How to read the ring check report – summary

- **It is the member’s responsibility to read the ring check report, investigate unusual z-scores and take corrective action.**
- Read the first page for any messages e.g. “Sample Barley Jan 2018/01 is not homogeneous hence variable z-scores”.
- Then look at the rows at the top of each table that compare the robust mean of all the members NIR values with the assigned reference chemistry value. Normally these will agree quite well.
- Then identify your laboratory by its network number and look at your reported values and z-scores.
- Interpret your z score as indicated above. Remember : A single high z-score may be a “one off” sample problem or operator error.
- If you have unsatisfactory z-scores, re-run the retained ring check samples and verify the results.
- Also note any instrument error or outlier codes.
- If the results are still unsatisfactory look at your daily internal control check charts – do they indicate a problem?

- Telephone the service department of your equipment supplier and outline your problem and concern. They will be able to advise you.
- You can also contact the UK Grain Testing Network Technical Administrator, (telephone 0333 301 1241, e-mail [admin@ukgrain.org](mailto:admin@ukgrain.org)) for general comment and advice.

## **Communications, Contacts and Problems**

With the size and nature of the Network, effective communication is very important.

There are many ways to communicate with us:

**E-mail** is the main method that we use to contact you, both with routine messages to all members and more urgent messages specific to your individual instrument.

Our systems can hold one Primary contact for each instrument who will receive all messages. In addition, we can hold one Secondary contact who we will contact if there is no response from the Primary Contact. We can also hold unlimited PT Portal contacts who will be copied in on any emails sent via the PT portal. These would usually be emails notifying of sample dispatch or report availability.

It is imperative that the Network Technical Administrator is kept informed of any changes in members' contact details. This is particularly true for changes to primary contact names and e-mail addresses.

At times email may not get through to some of the addressees as they get removed by spam filters. There can be a variety of reasons for this, one being if the message has a large circulation list, which some Network messages have. Therefore, it is important that members occasionally check their spam filter folders and try to get Network address added to "white lists" which should avoid messages being filtered out.

Emails from the network come from one of the following addresses:

- Vic Cameron - [admin@ukgrain.org](mailto:admin@ukgrain.org)
- Paul Allison - [Paul.Allison@Sciantec.uk.com](mailto:Paul.Allison@Sciantec.uk.com) or [UKNIRGrain@Sciantec.uk.com](mailto:UKNIRGrain@Sciantec.uk.com)
- PT Portal - [support@m360.co.uk](mailto:support@m360.co.uk)

Where it is important for your business that several individuals are copied in on emails from us, we would encourage you to set up mail forwarding rules within your organisation to ensure that this happens. We do not have a system to ensure that additional contacts are

The Network website is at [www.ukgrain.org](http://www.ukgrain.org) and the members only section is accessed using the password of "network". If it is not possible for any member to access the internet, then please inform the Technical Administrator. The website is now the main place where details of important information, changes and news will be posted. Members will be informed by e-mail when there are significant updates. The Members Handbook can be found in the members section of the website. Suggestions of other items that might be included should be sent to the Technical Administrator.

**Open forum, regional meetings and training sessions.** These have been held occasionally over the years (typically in Spring or Autumn, before or after the harvest) and have supplied an opportunity for Network members to meet and hear about Network issues and operations as well as training in topics such as instrument operation and interpretation of statistics used in ring check report. The future of these depend very much on members and their needs. A major aim of these meetings is to provide feedback to the steering committee on the Network operation to help improve and develop the facilities provided. If you feel there is a need for a regional meeting please inform the technical administrator and say what topics would be of interest.

**Industry Events.** The network may from time to time send representatives to various industry events to meet members, seek ideas and feedback and promote the network to potential new members.

**Social media.** The network has a presence on Twitter at <https://twitter.com/GrainNetwork>. Follow us and add us on to your Tweets if you think we would be interested using the hashtag @GrainNetwork.

## Contact details.

- **Instrument problems** - communication with instruments, spares, servicing, instrument performance, breakdown etc. need to be directed to the instrument supplier. Contact details for the equipment supplies can be found on the UKGTN website.
- **General queries about the Network** – For an explanation of ring check reports, changes in contact details or membership requirements, subscription rates, volunteering to supply samples, new ideas and other issues, contact the Network Technical Administrator, Vic Cameron on 0333 3011241 or [admin@ukgrain.org](mailto:admin@ukgrain.org)
- **Ring check reports and Samples** – Queries with ring check reports, non-arrival or damage of ring check samples, contact Paul Allison on 01757 2424000 or [Paul.Allison@Sciantec.uk.com](mailto:Paul.Allison@Sciantec.uk.com)
- **PT Portal** – Difficulties in logging on to the PT Portal or in using the portal which is found at <http://ukgn.sciantecptportal.co.uk> please contact Paul Allison on 01757 242400 or [Paul.Allison@Sciantec.uk.com](mailto:Paul.Allison@Sciantec.uk.com)
- **Committee Members** are based around the country and in different sectors of the grain industry. Please feel free to contact any of these if you wish to discuss industry or regional issues or other general points. Those marked w, b, r, o are contacts for wheat, barley, OSR and oats respectively.

Name	Organisation	Tel	Email
Vic Cameron	Network Technical Administrator	03333 011241	admin@ukgrain.org
Paul Allison	Sciantec	01757 242400	Paul.Allison@Sciantec.uk.com
Mark Blakemore (r)	Sharnbrook Grain Storage	07802 291171	
Alan Brown (b)	Bairds Malt	01241 435413	
Richard Denton	Openfield Agriculture	01476 862728	
Mark Hanger (w)	MHC Quality Assurance	01844 261261	
Lynn Hannam	Syngenta UK Ltd	01507 342004	
Alan King	Camgrain	01638 572800	
Nicky Lockey (w, r)	Frontier Agriculture	01767 688230	
Roland Fleming	Simpsons Malt	01289 333303	
Sharon Millard	Crisp Maltings	01328 828316	
Emily Henson	Frontier	01379 658141	
Audrey Young	Frontier	01349 888311	
Helen Appleyard	NIAB		Helen.appleyard@niab.com
James Ireland	Ireland Farms Ltd		james@irelandfarmsltd.com

The UK Grain Testing Network is a user group run for the benefit of its members. If you have any request or suggestions, please contact the Technical Administrator or any member of the Steering Committee.

Vic Cameron  
UK Grain Testing Network Technical Administrator

23<sup>rd</sup> December 2021