Animal & Plant Health Agency

Great Britain and Northern Ireland Variety List Trials: Trial Procedures for Official Examination of Value for Cultivation and Use (VCU) Harvest 2025

Cereals – Wheat, Barley, Oats, Triticale, Rye, Spelt Wheat

April 2024

Changes since last version

- Updated title from United Kingdom to Great Britain and Northern Ireland
- A.4.4.2 removed WB only from Obligatory – Resistance to harmful organisms.
- A.4.4.3 removed Plot yield (fungicide without plant growth regulator) (SO only) from Obligatory – yield
- A.4.4.7 removed Hagberg falling number, Endosperm texture, Bread-making quality, Biscuit-making quality from Additional-Quality characteristics
- Added detail for A.4.4.7 table to be in line with all other tables
- cleared up language for C.6.2.1
- removed extraneous language from F.1.3

Contents

Section A – General information

A.1 Purpose

A.1.1 This document sets out the approved procedures to be used for growing trials, tests and assessments as required by the current Protocol for Official Examination of Value for Cultivation and Use for Cereals (wheat, barley, oats, triticale, rye and spelt wheat).

A.2 Scope

A.2.1 These procedures apply to all varieties of cereals (wheat, barley, oats, triticale, rye and spelt wheat).

A.3 Responsibilities

A.3.1 **Procedures Development Group**
The Procedures Development Group is responsible for reviewing these procedures annually and making amendments for which it has responsibility, in accordance with the provisions of the VCU Protocol.

A.3.2 Organisers and Operators

A.3.2.1 Trials Organiser

British Society of Plant Breeders Ltd (BSPB)
BSPB House
114 Lancaster Way Business Park
Ely
Cambs.
CB6 3NX

Tel No: 01353 653846
Mobile: 07747 567351
Email: jeremy.widdowson@bspb.co.uk

A.3.2.2 The Trials Organiser is responsible for ensuring that all **VCU Protocol** and **Procedures** requirements are followed and for liaising with all Operators carrying out trials for National List purposes, including supply of seed and data handling.

A.3.2.3. Pathology Trials Operator

The Pathology Trials Operator appointed by APHA is responsible for co-ordinating the assessment of disease using Disease Observation Tussocks in accordance with the VCU Protocol and these Procedures.

A.3.2.4 Data Handling Operator

The Data Handling Operator identified by the Trials Organiser is responsible for trial design and data validation in accordance with the **VCU Protocol** and associated **Procedures.**

A.3.2.5 Growing Trial Operators, Seed Handling Operators and Quality Testing Operators.

The Trials Organiser is responsible for potential Growing Trial Operators and Quality Testing Operators to carry out trials and tests as determined by the Procedures Development annual review in accordance with the **VCU Protocol**, and these **Procedures**. The Trials Organiser is also responsible for finding Seed Handling Operators who are able to carry out seed handling. Seed Handling Operators prepare trial seed for sowing on behalf of any Growing Trials Operator in accordance with the **VCU Protocol** and these **Procedures**.

A.3.2.6 A list of all approved Organisers and Operators is shown Appendix 1.

A.3.3 **VCU protocol and procedures non-compliance**

A.3.3.1 Where these procedures use the words “must or will” for any action then failure to carry out this action will result in non-compliance. Where the word “should” is used for any action then this is the method to be followed unless there are clear reasons not to, which can be justified by the operator as technically sound.

A.3.3.2 The Trials Organiser will forward any reports on VCU Protocol or Procedures non-compliance to APHA within 1 week of receipt. The Trials Organiser will obtain authorisation from APHA for any actions, including those necessary to remedy non-compliances, which are not within the requirements of the VCU Protocol. Such actions must be recorded as non-compliance. Where emergency action is required and APHA staff are not available (e.g. evenings/weekends) the Trials Organiser should act but report this to APHA at the earliest opportunity. Where GMOs are concerned the arrangements are as detailed in section 3.4.

A.3.4 **Procedures for GM varieties**

A.3.4.1 The National Authorities and Trials Organiser will develop procedures for GM varieties if an application for a GM candidate variety is received.

A.3.5 **Processing of seed**

A.3.5.1 The Trials Organiser is responsible for organising the processing of seed of candidate varieties submitted by the applicant, and seed of control, or other reference varieties, in accordance with the requirements set out in these **Procedures** and the current **VCU Protocol**. The Trials Organiser will ensure that any seed treatments or additives are approved for the purpose. Approved products are listed in Appendix 2.

A.3.6 **Dispatch of seed**

A.3.6.1 The Trials Organiser will arrange for seed to arrive at the Seed Handling Operator by the relevant deadline – see Appendix 3. The Seed Handling Operator is responsible for processing and dispatch of seed to Growing Trials Operators. APHA are responsible for arranging submission of DUS seed and seed for authentication.

A.3.7 **Monitoring of Growing Trial Operators and Seed Handling Operators documentation**

A.3.7.1 The Trials Organiser will take any necessary action to enforce deadline dates and quality standards for required documentation.

A.3.7.2 The Trials Organiser will ensure Growing Trial Operators and Seed Handling Operators have access to all current protocols and procedures relevant to them and that they are notified of any amendments.

A.3.8 **Seed quantities**

A.3.8.1 The Trials Organiser will determine the quantity of seed required for all VCU tests and trials in each annual series, including authentication, and will notify the applicant of quantities and delivery addresses.

A.3 9 **Labelling of seed**

A.3.9.1 The Trials Organiser is responsible for ensuring all seed is clearly labelled with variety name/breeders' reference and AFP number.

A.3.10 **Seed quality**

A.3.10.1 Seed submitted for VCU testing should meet the standards for the final generation of seed given in the appropriate seed regulations, in respect of germination, analytical purity and content of other seeds and any other impurities.

A.4 Summary of growing trials, tests and assessments procedures

A.4.1 The number of trials and site locations are as detailed in Appendix 4.

A.4.2 Control varieties are listed in Appendix 5. A commercially available naked oat variety is grown if there are naked oat candidates in trial. The naked comparator is not a yield control.

A.4.3 The Trials Organiser is responsible for informing the Growing Trial Operators of the additional characters, which must be recorded as and when requested by applicants, and any samples that may be required for analysis.

A.4.4 VCU trial assessments required

A.4.4.1 **Wheat**

Type of character	Reference	Description of assessment - Obligatory	Description of assessment – Additional (Assessed only if requested by applicant.)
Yield	Section C	**Plot yield (treated)** **Plot yield (untreated) (WW only)** **Moisture content (treated)** **Moisture content (untreated) (WW only)**	
Behaviour with respect to factors in the physical environment.	Section C	**Lodging (treated)** **Lodging (untreated) (WW only)** **Leaning (treated)** **Leaning (untreated) (WW only)**	*Ripening date* *Straw length*
Resistance to harmful organisms	Section D	**Mildew** **Yellow rust** **Brown rust** ***Septoria tritici** ***Septoria nodorum (WW ONLY)** **Eyespot (inoculated test only)** **Fusarium ear blight**	*Sharp eyespot (inoculated test only)* *Fusarium (inoculated test only)* *Soil Borne Wheat Mosaic Virus*

Type of character	Reference	Description of assessment - Obligatory	Description of assessment – Additional (Assessed only if requested by applicant.)
Quality characteristics (Laboratory tests)	Section E	**Specific weight**	*Protein content* *Hagberg falling number* *Endosperm texture* *Bread making quality* *Biscuit making quality* *Thousand grain weight*

*Growing Trial Operators may find it difficult to differentiate between Septoria species in field trials and may record as *Septoria species.*

NB Not all trials have untreated plots
Further measurements
The following must be measured or recorded in all trials, following procedures in Section C.

Sowing date
Harvest date
Pre-harvest shedding
Plot size
Plant population
Combine losses
Sprouting
Bird damage
Winter hardiness (WW only)

A.4.4.2 **Barley**

Type of character	Reference	Description of assessment - Obligatory	Description of assessment – Additional (Assessed only if requested by applicant.)
Yield	Section C	**Plot yield (treated)** **Plot yield (untreated)** **Moisture content (treated)** **Moisture content (untreated)**	
Behaviour with respect to factors in the physical environment.	Section C	**Lodging (treated)** **Lodging (untreated)** **Leaning (treated)** **Leaning (untreated)** **Ear loss**	*Ripening date* *Straw length*
Resistance to harmful organisms	Section D	**Mildew** **Yellow rust** **Brown rust** **Rhynchosporium** **Net blotch**	*Ramularia*
Quality characteristics (Laboratory tests)	Section E	**Specific weight**	*Hot water extract (HWE)* *Thousand grain weight* *Nitrogen content*

NB Not all trials have untreated plots

Further measurements
The following must be measured or recorded in all trials, following procedures in Section C.

Sowing date
Harvest date
Pre-harvest shedding
Plot size
Plant population
Combine losses
Sprouting
Bird damage
Brackling
Winter hardiness (WB only)
BMMV/BYMV (WB only)
BYDV (SB only)

A.4.4.3 **Oats**

Type of character	Reference	Description of assessment - Obligatory	Description of assessment – Additional (Assessed only if requested by applicant.)
Yield	Section C	**Plot yield treated and untreated** **Moisture content treated and untreated**	
Behaviour with respect to factors in the physical environment.	Section C	**Lodging treated and untreated** **Leaning treated and untreated**	*Ripening date* *Straw length*
Resistance to harmful organisms	Section D	**Mildew** **Crown rust**	*Septoria avenae*
Quality characteristics (Laboratory tests)	*Section E*	**Kernel content** **Specific weight** **Sieving fraction**	*Protein content* *Thousand grain weight*

Further measurements
The following must be measured or recorded in all trials, following procedures in Section C.

Sowing date
Harvest date
Yield
Plot size
Plant population
Combine losses
Sprouting
Bird damage
Pre-harvest shedding
Winter hardiness (WO only)
Brackling

A.4.4.4 **Triticale**

Type of character	Reference	Description of assessment - Obligatory	Description of assessment – Additional (Assessed only if requested by applicant.)
Yield	Section C	**Plot yield (treated)** **Moisture content (treated)**	
Behaviour with respect to factors in the physical environment.	Section C	**Lodging (treated)** **Leaning (treated)**	*Ripening date* *Straw length*
Resistance to harmful organisms	Section D	**Mildew** **Yellow rust** **Brown rust** ***Septoria tritici**	
Quality characteristics (Laboratory Tests)	Section E	**Specific weight**	*Protein content* *Thousand grain weight*

*Growing Trial Operators may find it difficult to differentiate between Septoria species in field trials and may record as *Septoria species*.

Further measurements
The following must be measured or recorded in all trials, following procedures in Section C.

Sowing date
Harvest date
Pre-harvest shedding
Plot size
Plant population
Combine losses
Sprouting
Bird damage
Winter hardiness (WT only)

A.4.4.5 **Rye**

Type of character	Reference	Description of assessment - Obligatory	Description of assessment – Additional (Assessed only if requested by applicant.)
Yield	Section C	**Plot yield (treated)** **Moisture content (treated)**	
Behaviour with respect to factors in the physical environment.	Section C	**Lodging (treated)** **Leaning (treated)**	*Ripening date* *Straw length*
Resistance to harmful organisms	Section D	**Mildew** **Brown rust** ***Septoria tritici**	
Quality characteristics (Laboratory Tests)	Section E	**Specific weight**	*Protein content* *Hagberg falling number* *Endosperm texture* *Bread making quality* *Biscuit making quality* *Thousand grain weight*

*Growing Trial Operators may find it difficult to differentiate between Septoria species in field trials and may record as *Septoria species*.

Further measurements
The following must be measured or recorded in all trials, following procedures in Section C.

Sowing date
Harvest date
Pre-harvest shedding
Plot size
Plant population
Combine losses
Sprouting
Bird damage
Winter hardiness (WR only)

A.4.4.6 **Spelt wheat**

Type of character	Reference	Description of assessment - Obligatory	Description of assessment – Additional (Assessed only if requested by applicant.)
Yield	Section C	***Plot yield** **Moisture content (managed)**	
Behaviour with respect to factors in the physical environment.	Section C	**Lodging (managed)** **Leaning (managed)**	*Ripening date* *Straw length*
Resistance to harmful organisms	Section D	**Mildew** **Yellow rust** **Brown rust** ***Septoria tritici**	
Quality characteristics (Laboratory Tests)	Section E	**Specific weight**	*Protein content* *Hagberg falling number* *Endosperm texture* *Bread making quality* *Biscuit making quality* *Thousand grain weight*

*Unlike treated trials which have a prescribed programme in the procedure, managed trials are grown to best local practise with disease managed to ensure it does not endanger the validity of the trial.

*Growing Trial Operators may find it difficult to differentiate between Septoria species in field trials and may record as *Septoria species.*

Further measurements
The following must be measured or recorded in all trials, following procedures in Section C.

Sowing date
Harvest date
Plot size
Plant population
Combine losses
Sprouting
Bird damage
Pre-harvest shedding
Winter hardiness (WSW only)

A.4.4.7 **Durum wheat**

Type of character	Reference	Description of assessment - Obligatory	Description of assessment – Additional (Assessed only if requested by applicant.)
Yield	Section C	***Plot yield** **Moisture content (managed)**	
Behaviour with respect to factors in the physical environment.	Section C	**Lodging (managed)** **Leaning (managed)**	*Ripening date* *Straw length*
Resistance to harmful organisms	Section D	**Mildew** **Yellow rust** **Brown rust** ***Septoria tritici**	
Quality characteristics (Laboratory Tests)	Section E	**Specific weight**	*Protein content* *Thousand grain weight*

*Unlike treated trials which have a prescribed programme in the procedure, managed trials are grown to best local practise with disease managed to ensure it does not endanger the validity of the trial.

*Growing Trial Operators may find it difficult to differentiate between Septoria species in field trials and may record as *Septoria species.*

Further measurements
The following must be measured or recorded in all trials, following procedures in Section C.

Sowing date
Harvest date
Plot size
Plant population
Combine losses
Sprouting
Bird damage
Pre-harvest shedding
Winter hardiness (WDW only)

Section B – Seed handling procedures

B.1 Responsibilities

B.1.1 Seed Handling Operators or Growing Trial Operators are responsible for carrying out the following seed handling procedures.

B.2 Seed handling procedures

B.2.1 Seed Handling Operators/Growing Trial Operators will receive a sowing list from the Trials Organiser, along with instructions as to which seed treatments or additives may be used. A list of chemicals approved by the Procedures Development Group is at Appendix 2.

B.2.2 Seed Handling Operators/Growing Trial Operators must record receipt of seed from applicants by checking it off against the sowing list as it arrives. The Trials Organiser and Applicant should be notified of any damage to the packaging, loss of seed or identification problems within one working day of receipt.

B.2.3 Each Seed Handling Operator (or Growing Trial Operator if handling the seed) must retain 200 grams untreated sample of the seed submitted of every variety in the trial, for authentication by the DUS test centre.

B.2.4 Seed Handling Operators/Growing Trial Operators must record use of treatment chemicals in accordance with best practice and in full observance of all manufacturers' recommendations and relevant statutory obligations.

B.2.5 Any seed treatment equipment used must be fit for the purpose, properly calibrated, set up and operated in accordance with the manufacturer's recommendation.

B.2.6 Cross contamination must be avoided by ensuring equipment is clean between weighing and treatments.

B.2.7 A record must be kept of chemicals used and date of treatment.

B.2.8 Seed treatment should take place as near to the drilling date as possible.

B.2.9 Once seed has been treated, it must be kept safely until required for drilling and quality control. Each Seed Handling Operator must retain a 100 gram sample of treated seed until one month after harvest.

B.3 Authentication of VCU seed

B.3.1 The Trials Organiser will notify the minimum quantity required for authentication to Growing Trial Operators/Seed Handling Operators annually. Authentication samples are not required from Growing Trial Operators who receive seed from another Seed Handling Operator. All samples for authentication must be retained until one month after harvest.

B.3.2 All samples must be kept under suitable conditions for the authentication procedures required and must be clearly labelled and sealed.

B.3.3 APHA will select samples from Growing Trial Operators/Seed Handling Operators for authentication at DUS test centre.

B.3.4 Growing Trial Operators/Seed Handling Operators must send requested samples to the DUS test centre by the date specified by APHA.

B.3.5 Where there is more than one Seed Handling Operator, APHA will select samples for authentication from at least two Seed Handling Operators.

B.3.6 If the level of off types recorded in DUS tests or VCU authentication of a candidate exceeds 10%, the VCU tests will be considered invalid.

Section C – Growing trial procedures

C.1 Responsibilities

C.1.1 The Growing Trial Operators are responsible for conducting the trials according to these procedures.

C.2 Site suitability

C.2.1 The Growing Trial Operator will be responsible for providing a suitable site, which meets the following criteria:

C.2.2 Previous cropping must be appropriate for a cereal crop to be grown.

C.2.3 Soil type should be typical of those on which cereals are grown locally. Soil fertility and texture should be uniform across the site. The soil should be sufficiently uniform to avoid variation in the growth of the trial.

C.2.4 The trial should be sited away from trees, hedges, headlands and other features, which are likely to cause uneven growth or encourage damage from fauna.

C.2.5 The trial area should be cultivated in the direction of primary cultivation and drilled across the direction of ploughing and cultivation such that each plot receives similar wheeling compaction. Cultivations should follow best local practice.

C.3 Sowing the trial

C.3.1 **Plot size**

C.3.1.1 For treated trials, the harvested plot area per variety must be not less than 19 m^2 per replicate for trials with two replications and 15 m^2 per replicate for trials with 3 or 4 replications. For untreated trials the harvest plot must be not less than 15 m^2 for 2 or 3 replicates (minimum plot length for DOPS is 4 m). For treated spring wheat, winter and spring oats, winter and spring triticale, rye, durum wheat and spelt wheat a minimum of 3 replicates must be sown. For untreated spring wheat a minimum of 2 replicates must be sown. Plots must be drilled to a greater length than required and cut back to the required length prior to harvest. The plot width for calculating the harvested area is measured from outer row to outer row, plus half the inter-plot gap on either side. The allowance for the inter-plot gap must be no greater than 0.45 m.

C.3.2 **Plant population**

C.3.2.1 The following tables give the target populations for each crop, i.e. the final plant population per m^2 after any losses due to poor germination or establishment. The target population for all hybrid crops, other than wheat will be 70% of that for non-hybrid varieties. The target population for hybrid wheat varieties will be 85% of that for non-hybrid wheat varieties.

	Population plants/m2	
Crop	**England and Wales**	**Scotland and N. Ireland**
Winter wheat	200 to 300 depending on conditions at the time using the following as a guide: 200 for Sept sowings (170 for hybrids) 250 for Oct sowings (213 for hybrids) 300 for Nov sowings (255 for hybrids)	
Winter barley	275 (hybrids 193)	320 (hybrids 225)
Winter oats	275	320 – 350
Spring wheat	320	-
Spring barley	300 - 325*	300 - 350
Spring oats	300 - 325	300 - 350
Triticale	300 - 325	300 - 350
Rye	300 - 325 (hybrids 210-230)	300 - 350 (including hybrids)
Spelt Wheat	300 - 325	300 - 350

The following formula will be used to calculate the seed rate for a given thousand seed weight: -

Seed rate (kg/ha) = $\frac{\text{((Target population x Thousand seed weight) x 100)}}{\text{(Establishment\% x Germination \%)}}$

The likely establishment should be judged carefully depending on soil conditions and seedbeds. Growing Trial Operators are responsible for achieving the correct target populations.

***** Contact Trials Organiser if there is a need to increase the plant population.

For operators using seed counters the following formula can be used to calculate required seed numbers per plot: -

Seeds per plot = $\frac{\text{((Target population x Drilled plot area) x 10,000)}}{\text{(Establishment \% x Germination \%)}}$

C.3.3 **Trial layout**

C.3.3.1 The Trials Organiser following consultation with APHA produces provisional sowing lists. The Trials Organiser will make final sowing lists available to Growing Trial Operators, along with the trial plans produced by the Data Handling Operator.

C.3.3.2 The trial should be sown according to the plan produced by the Data Handling Operator and may be an incomplete block design. In an incomplete block design, each replicate is split into a number of sub-blocks. Any splitting of replicates must be between sub-blocks and not through sub-blocks. Varieties can be moved within a sub-block but must not be moved from their sub-block. Varieties must not be moved around within the plan e.g. if drilling errors occur. If plots are moved out of their original sub-block they will have to be treated as missing plots. If there are any queries, please contact the Trials Organiser.

C.3.3.3 Buffer plots may be required in some instances; e.g. where there is a significant height difference between a variety or varieties. The Trials Organiser will advise if this is the case. For Winter barley trials only, to mitigate identified issues resulting from shading, varieties in each replicate will be assigned to one of three groups based on whether they are 2-row, 6-row non-hybrid or 6-row hybrid varieties as a generalised way of separating by height. The trial designs will show clearly where the appropriate buffers should be inserted in the trials.
C.3.3.4 If there is a need to replace a planned variety e.g. if varieties are withdrawn, affected plots must be sown with any of the standard control varieties. Any such replacements must be agreed with the Trials Organiser. The control varieties are listed in Appendix 5. Occasionally for other crops, such as Winter oats, buffer plots may be required in some instances, e.g., where there is a significant height difference between a variety or varieties. The Trial Organiser will advise if this is the case.

C.3.4 Drilling

C.3.4.1 If drilling is likely to be delayed beyond 31 January consult Trials Organiser.

C.3.4.2 Drills to be set up, calibrated and used only when conditions are right. The Trials Organiser must be notified if drilling is to be delayed beyond normal local practice.

C.3.4.3 Care must be taken with drill settings and drilling speed to ensure satisfactory and uniform establishment and plant population from plot to plot. It is also important to ensure that there is no carry-over of seed between plots.

C.3.4.4 At least ***one*** discard plot must be drilled on either side of the trial with the same drill and at the same time that the trial is drilled. In the case of oats, the discard plots must be a hulling susceptible variety.

C.3.4.5 Precautions must be taken to avoid any missing rows. Any missing rows or parts of rows must be noted in the trial diary and reported to the Trials Organiser within one month of emergence.

C.3.5 **Confirmation of trial layout**

C.3.5.1 After full establishment and within two months of sowing (autumn sown trials) or one month of sowing (spring sown trials) the Growing Trial Operator must confirm that the trial has been sown to plan or give details of any changes to plan. This should be done by clearly highlighting the changes in the electronic plan and returning it to the Data Handling Operator.

- Return a completed site data 1 sheet including the following information:
- Site location details including how to get to the field.
- Sketch showing the layout of the trial in the field, in relation to other trials and showing access roads, gates, etc. The location of the access gates should utilise the navigation platform What3Words.com
- Trial sketch showing plot numbers and variety codes and/or names.
- A short post-establishment report of the condition of the trial.

C.4. Husbandry

C.4.1 **Agronomy**

Where not specified in these procedures agronomy should follow best local practice, advisory and regulatory guidelines. Application of fertilisers and sprays should be uniform. It is normally best to apply these across the direction of the plots. Application wheelings should not run through the harvested plot area.

C.4.2 Fertiliser application

It should take into account inherent fertility, previous cropping, winter rainfall and the best local practice. All fertiliser applications should take account of the AHDB Nutrient Management Guide (RB209), the corresponding advisory publications in England, Wales, Scotland and Northern Ireland and past trialling experience.

C.4.3 **Herbicides**

The Trials Organiser must be consulted. Any sensitivity to herbicides must be reported to the Trials Organiser.

C.4.4 **Growth regulators**

The schedule is shown in Appendix 6. Growth regulators must only be used on treated and managed trials and should be used to keep lodging to a minimum.

Note that there are restrictions on the use of plant growth regulators. The manufacturer's instructions must be followed.

C.4.5 **Pest and disease control**

C.4.5.1 **Pest control**

Appropriate seed dressings must be applied as approved by the Trials Organiser Appendix 2. Precautions should be taken against attacks by birds, molluscs, mammals, and insects such as wireworm, leatherjackets and wheat bulb fly.

C.4.5.2 **Disease control**

All treatments applied should be according to the schedule in Appendix 7. In exceptional circumstances it may be necessary to deviate from the programme; e.g. additional sprays may be required during periods of extremely high disease pressure, or reduced rates may be required for drought stressed trials under low disease pressure. The Trials Organiser must be consulted before taking such a decision.

Treated plots will receive a fungicide programme designed to keep controllable disease levels below 5%.

Untreated trials will receive no fungicide.

Managed trials are normally non-fungicide treated but fungicide may be applied if severe disease (such as yellow rust) is establishing. The Trials Organiser must be consulted if disease is building up above 5% in any of the control varieties.

C.4.5.3 **Lodging control**

Treated and managed trials will receive a plant growth regulator (PGR) according to Appendix 6.

C.4.6 **Irrigation**

Irrigation will not be permitted without the specific agreement of the Trials Organiser.

C.4.7 **Pathways**

There should be a minimum of 2m between treated and untreated replicates.

C.5 Harvesting

C.5.1 Timing of harvesting

C.5.1.1 Date of harvesting will be determined by the Growing Trial Operator based on crop maturity and local weather conditions.

C.5.1.2 Plots should be trimmed to their final length prior to harvesting. The plot dimensions must be measured prior to harvesting. Any one plot of 1 variety may be shortened by up to half its length. If it is necessary to reduce the size of any plot at harvest, give clear details on the yield file. Individual harvested plot lengths should be recorded.

C.5.2 **Harvesting method: direct combining**

Combine settings must be optimal for the crop. For oats in particular, settings should ensure excessive de-hulling does not take place. This must be done by taking samples from the discard plots of varieties that are susceptible to de-hulling and counting the number of de-hulled grains, aiming at no more than 5 de-hulled grains per 100.

The Trials Organiser will alert you if he is aware of susceptible varieties in the trial.

C.5.2.1 **Pre-harvest desiccation**

Pre-harvest desiccation should not be used. In exceptional circumstances and on a case-by-case basis, desiccation of the whole trial may be allowed but this must be discussed and agreed in advance with the Trials Organiser.

C.5.3 **Samples**

C.5.3.1 It is essential that all samples:

- Are representative of the variety/plot from which they are taken with minimal contamination. When sampling on-combine, it is essential to minimise the risk of contamination of grain from the previous plot.
- Are taken from the same source.
- Contain the weight of grain requested.

C.5.3.2 Moisture content samples must be assessed from every yield plot in the trial by the Growing Trial Operator. If moisture content cannot be assessed electronically (see Appendix 8 a sample of at least 200 g from each plot must be taken at the time of plot weighing and sealed in a moisture proof container for Dry Matter determination by the oven method using the method in Appendix 8.

C.5.3.3 All bagged samples must be kept in good condition at a moisture content and temperature appropriate for long term storage. They should be clearly marked both inside and outside the container/bag.

C.5.3.4 Samples may not be required from every variety - the Trials Organiser will provide details of which varieties require samples, the quantities required and the tests to be carried out.

C.5.3.5 Sample drying should be undertaken, on site, using a cold/warm air drier. Except for malting barley, the aim is to reduce moisture content to 15% or below. Malting barley (micro malting groups) should be dried to 12% moisture content or below. The temperature of the drying air should not exceed 45°C for barley and 60ºC for other crops

C.5.3.6 All plot samples must be labelled with trial identification number, variety name/breeders' reference, AFP number, plot number and Growing Trial Operator identification number. Where it is necessary to store samples, it is very important that they are stored in good conditions, dry and vermin free. Discuss any drying or storage problems with the Trials Organiser.

C.5.3.7 A 1kg Quality/Reference sample for each variety should be taken at harvest. This will be used for determining quality characters according to crop. The samples should be sent to the appropriate Quality Testing Operator as soon as practicable after harvest, or after the completion of any drying where this is necessary. Notification of dispatch should be faxed or emailed to the Trials Organiser at the same time. The sample remaining after testing will be kept as a reference sample. There are three levels of priority for dispatch of samples:

1. Samples to be sent immediately after harvest.
2. Those to be sent as soon as possible after harvest, once the moisture content of the samples has been dried down to 12% (barley) or 15 % (other crops). Samples should be in transit within 48 hours of harvest, if drying takes longer than this, contact the Trials Organiser.
3. Those to be held on site at 12% or 15% moisture content awaiting further instructions (micro malting groups). Once notification is received that samples are required, it is very important that they are dispatched quickly (within 48 hours of notification).

C.5.3.8 Where additional quality tests are requested by applicants, the Trials Organiser will provide appropriate instruction and labels. The samples should be dispatched to the appropriate Quality Testing Operator as soon as practical after harvest, or after completion of drying where necessary.

C.5.4 **Submission of data and samples**

C.5.4.1 Appendix 9 lists the records, with deadlines, to be sent to the Trials Organiser. Diary sheets and other field records should be returned to the Trials Organiser within 5 working days.

C.5.4.2 All plot records should be transmitted to the Data Handling Operator following the deadlines set out in Appendix 9. The Growing Trial Operator should ensure that data are free from errors before transmission. After scrutiny, copies of results will be returned to the Growing Trial Operator for action as agreed by the Trials Organiser.

C.5.4.3 All samples should be sent to the appropriate Quality Testing Operator following the deadlines set out in Appendix 9.

C.6 Records

C.6.1 There are four components:

1. **Diary** Field notes of trial status.

*2. **Site data part 1** Including full location details:
1) map of site location showing nearby settlements and roads,
2) a sketch showing the layout of trials in the field with access points and
3) trial layout, showing plot numbers and variety codes/names.

*3. **Site data part 2** Details of agrochemical applications and irrigation.

4. **Plot records** Plot data.

* Template available from Trials Organiser

C.6.1.1 An entry in the Diary sheet should be made on every trials visit and any observations relevant to variety performance should be recorded. If the trial is in good condition, with no problems, this should be recorded.

C.6.2 Plot records

C.6.2.1 Plot data may be recorded direct onto a data logger or recorded on paper. A system of ensuring that data are recoverable, in the event of loss of original data, must be implemented, e.g. copy and safe storage. Whichever method is used, individual plot data will only be accepted by the appropriate Data Handling Operator in an approved format using the variety names and units as listed in Sections C and D.

C.6.2.2 All observations should be checked at the time of recording to ensure that they lie within acceptable limits for the character recorded. Observations that have been designated as exceptional by the recorder should be identified with a note on the approved data file or hard copy medium describing the possible causes together with a recommendation for their exclusion or inclusion in the trial analysis.

C.6.2.3 Plot numbers on record sheets must correspond with the numbering on the field plan.

C.6.2.4 If a character is not recorded or is missing the Growing Trial Operator should indicate in the diary or on the recording sheet the reason why it has been excluded.

C.6.2.5 Where a plot record is missing the Growing Trial Operator should enter “*” in the approved data file or hard copy medium and, unless the non-recording of the plot has already been agreed with the Trials Organiser, append a note to the file explaining why a missing value has been entered for that plot. The Growing Trial Operator should not enter “0” for missing plots.

C.6.2.6 Specific plot records should be made as counts or on the scales shown for each character. Only the character names as listed may be used. All records should be returned to the Data Handling Operator as soon as possible after they are completed.

C.6.2.7 All records should be returned as soon as reasonably possible and when complete for the whole trial. Indicative deadlines are given in Appendix 9. All records must be returned by the final deadlines.

C.6.3 **Procedures for recording characters**

C.6.3.1 The following procedures must be followed for measuring all characters to be used in NL decision-making.

C.6.3.2 **SOWING DATE of each trial (OBLIGATORY) (Day/month/year)**

This is recorded in Part 1 of the Site Information Form.

C.6.3.3 **PLANT POPULATION from all plots (OBLIGATORY) (1-9)**

This must be recorded (1-9). 9=no loss. The number of plants/m^2 for the highest and lowest value should be recorded.

C.6.3.4 **WINTER HARDINESS (OBLIGATORY) (1-9)**

To be taken from autumn sown trials. Records should be taken from all plots. At the discretion of the Growing Trial Operator the character should be recorded after any period of freezing conditions. At least one record should be taken before the onset of spring growth, even if no damage is observed. Varieties should be scored on a 1-9 scale, where 9 = no damage.

C.6.3.5 **PLOT YIELD AND MOISTURE CONTENT (OBLIGATORY) (kg)**

The following information must accompany the yield data:

The moisture content % of the harvested grain, determined either by oven or an approved electronic method. See Appendix 8.

Plot length: the plot length harvested in metres.
Plot width: the width of the harvested plot in metres from outer row to outer row plus half of the inter-plot gap on either side. The allowance for the inter-plot gap should be no greater than 0.45m.

If these are not the same for every plot, a separate record must be submitted

Growth stage: usually 92 at harvest. The Growth Stage Chart for cereals is at Appendix 10.

Yield (in kilograms). Note clearly any tare weight to be subtracted.
Yield, Moisture content, Plot length, Plot width and harvest date data should be sent to appropriate data handling centre within 5 days of harvesting the trial.

C.6.3.6 **LODGING from all plots** **(OBLIGATORY)** **(%)**

Lodging is defined as areas of the plot where the stem buckling at the base of the plant to an angle greater than 45° to the vertical. The Growing Trial Operator should assess lodging at a stage that provides good discrimination between varieties and be prepared to repeat the assessment if further lodging develops. If lodging does not occur, it must be recorded as 0.

C.6.3.7 **LEANING from all plots** **(OBLIGATORY)** **(%)**

Normally recorded at the same time as lodging. Leaning % is defined as areas of the plot leaning to not more than 45° to the vertical.

C.6.3.8 *RIPENING DATE* *(ADDITIONAL)* *(Day/Month/Year)*

Measured from treated plots where available - otherwise from untreated trials. Ripening date is defined as when the grain is first hard, and difficult to divide by thumbnail (Growth stage 91). The crop may not necessarily be ready to cut at this stage. Records for this character should be taken from all yield plots of requested variety and controls.

It may be necessary to use straw colour as the criterion for ripeness.

The date should be given numerically as day, month, and year and written in full for each plot.

Example 02/07/13

The rate at which the crop ripens is dependent on weather conditions, but daily assessments may be necessary during hot, dry conditions.

An alternative method of assessing ripening date where daily visits are not practicable is described below.

The assessment should take place where the earliest variety is at growth stage 91. Use a 1-9 scale to record maturity e.g.

9	8	7	6	5	4	3	2	1
Ripe	2 days later	4 days later	6 days later	8 days later	10 days later	12 days later	14 days later	16 days later

Record each plot for varieties and controls if this character is requested in the trial on the 1 to 9 scale. A second visit to confirm the earlier observation would be advisable.

Convert the 1 to 9 scale to dates. PLEASE SEND IN THE RIPENING DATES **NOT** THE 1-9 ASSESSMENTS. E.g.

Plot	Score (2/8/13)	Estimated ripening date
1	9	02.08.13
2	8	04.08.13
3	5	10.08.13
4	4	12.08.13
5	2	16.08.13
6	7	06.08.13

C.6.3.9 **SHEDDING from all plots** **(OBLIGATORY)** **(1-9)**

9 = no shedding. Shedding occurs in the mature plant. Indicate the estimated number of grains lost per m^2 for the lowest score given on the 1 to 9 scale.

C.6.3.10 *STRAW LENGTH* *(ADDITIONAL)* (cm)

Records should be taken from untreated plots only, but if these are not available then from treated plots.

Using a graduated rod, the general height of the plot must be measured from at least one point in the plot chosen at random. The measurement must be from ground level to the top of the ear/panicles, ignoring awns.

C.6.3.11 **HARVEST DATE** **(OBLIGATORY)** **(Day/month/year)**

C.6.3.12 **COMBINE LOSSES from all plots** **(OBLIGATORY)** **(1-9)**

9 = no combine losses. Combine losses should be assessed if the losses are thought sufficient to exclude the yield data from results. Indicate the estimated number of grains lost per m^2 for the lowest score given on the 1 to 9 scale.

C.6.3.13 **SPROUTING from all plots** **(OBLIGATORY)** **(%)**

Sprouting in the ear of the mature plant is an important field character and has a detrimental effect on grain quality. Harvested samples from all plots in the trial should be taken if conditions have been conducive for sprouting and evidence of visible sprouting is seen in the plots at a level which will affect results. The assessment of sprouting should be based on observations on these grain samples.

C.6.3.14 **EAR LOSS from all plots (OBLIGATORY - barley) (1-9)**

9 = no ear loss. Usually occurs in barley as a result of necking. This is an important field character and should be assessed whenever it occurs. Estimate the number of ears lost per m^2 for a specified rating on the 1 to 9 scale.

C.6.3.15 **BIRD DAMAGE from all plots (OBLIGATORY) (1-9)**

9 = no bird damage. This must be recorded where there is evidence of bird damage present at a level which will affect results.

C.6.3.16 **BRACKLING from all plots (OBLIGATORY - barley and oats) (%)**

This term refers to buckling of the straw at a point well above ground level. It occurs particularly when the crop has become overripe but varietal differences may occur at an earlier stage.

C.6.4 **Site factors**

Any factors which may have affected the yield of the trial or individual plots must be noted and accompany the yield data.

Where varietal differences are seen in pest or disease attack, records should be made in accordance with the procedure in Section D for disease.

Records for other scores should be taken as plants affected on a 1 to 9 scale. Include definitions for each rating on the 1 to 9 scales.

C.6.5 **Trial inspection**

All trials will be inspected by the Trial Inspection and Technical Validation Operator and, in some cases, it may be necessary to visit on more than one occasion.

The requirements for Growing Trial Operators in respect of inspections are as follows:

1 To give reasonable access to trials to inspectors.
2 To supply the inspector with information (for example sprays applied etc) within seven days of a request.
3 To co-operate with the inspector in making any non-routine assessments required to establish the validity of the trial (for example population counts).
4. To carry out any action agreed in consultation with the inspector. In particular it is important that any requirement to shorten plots is undertaken. The data on plots that the trials operator and inspector agree to exclude should not be submitted.

Section D – Disease testing procedures

D.1 Assessment of natural infection

D.1.1 **Disease observation tussocks**

D.1.2 The Pathology Trials Operator appointed by APHA is responsible for co-ordinating these procedures.

D.1.3 Disease observation tussocks (DOTs) are small plots specifically sited in disease prone areas, where they are at high risk from natural infection. Sites may be in farm crops or adjacent to trials, but in either situation must be kept free of fungicides. All NL1 and NL2 candidate varieties and VCU controls, together with standard varieties of known resistance, are sown in DOTs. The set of plots is usually un-replicated but sometimes comprises 2 replications.

The precise location of sites may vary from year to year. The number of DOT sites (including Scotland and N. Ireland) is reviewed annually.

D.2 Naturally occurring disease in VCU growing trials

D.2.1 The Growing Trial Operator is responsible for carrying out these procedures.

D.2.2 Untreated trials and/or Disease Observation Plots (DOPs) will be grown with no fungicide treatment. A barrier of at least 2m of untreated crop should be left between the treated and untreated plots and it is the responsibility of the Growing Trial Operator to ensure that fungicide does not drift onto untreated areas. Disease Observation Plots do not need to be taken to yield and can be used for the recording of straw characters and natural disease infection.

D.2.3 **Diseases recorded**

D.2.3.1 The following diseases must be recorded if they reach the infection levels specified

	Abb.	Winter wheat	Spring wheat	Winter barley	Spring barley	Winter oats	Spring oats	Triticale	Rye	Spelt wheat
Mildew	MIL	√	√	√	√	√	√	√	√	√
Yellow rust	YR	√	√	√	√			√		√
Brown rust	BR	√	√	√	√			√	√	√
Septoria nodorum*	SEPN	√								
Septoria tritici*	SEPT	√	√					√	√	√
Rhynchosporium	RHYN			√	√					
Net blotch	NB			√	√					
Crown rust	CR					√	√			
Fusarium ear blight	FEB	√								
Septoria avenae	SEPA					√	√			
Ramularia **	RAM			√	√					

*Although every effort should be made to differentiate between *Septoria* species in field trials, growing trial operators may occasionally find it impossible. In this case symptoms may be recorded as *Septoria species.*

Scores should be taken from the middle of plots, never the edge. There are only about 5-7 days when you can get an accurate Ramularia assessment, so trials should be visited regularly **from flowering onwards to monitor the progression of the disease.

√ Obligatory score

D.2.4 **Timing of assessments**

At or slightly before GS 31	Record foliar disease if moderate infections (around 5%) occur in any plot. If an early optional spray is to be applied a score should be made before application.
GS 31-55	An assessment of foliar disease is required if moderate infections (around 5) develop in any plot.
GS 55-80	Once 5% is reached, aim to assess the trial every two weeks, or frequently enough so that meaningful disease scores can be obtained i.e. the progression of the disease from one assessment to another can be tracked. This may mean visiting the trial more than every 2 weeks, or less than every 2 weeks.

D.2.5 **Assessment keys**

D.2.5.1 The keys to be used for routine assessments are included in Appendix 11.

Disease to be recorded on a percentage scale as given in the assessment keys. For diseases or disorders for which no standard key exists, a scale which increases with severity should be used.

D.2.6 **General assessment procedures**

	Only assess diseases which reach a minimum of 5% infection in any one untreated plot. Where disease is present in fungicide treated trials, please see (vii).
	Each time a trial is assessed for disease, please enter a comment on the status of diseases which have not been assessed e.g. that they are absent or less than 5%.
	Assess disease in all replicates of the trial, except for treated replicates when they are disease free.
	Assess foliar diseases on a 'whole-plot' basis, i.e. make an overall assessment of the average percentage infection on all tillers in a small area of the plot and repeat at a minimum of 4 points in each plot. Do not restrict examination to individual tillers or individual leaves.
	Where primary foci of high infection occur, these should be averaged over the plot as a whole.
	For foliar diseases, examine the top 4 leaves. As the lower leaves senescence naturally at later growth stages it will become necessary to examine only the top 3 or 2 leaves or, in the case of very late assessments, the flag leaves alone.
	Fungicide treated trials must be inspected for failure to control disease. A full record must be taken if the infection level for any disease reaches 5% or greater. A comment on the disease levels in treated trials should accompany all disease records from the corresponding untreated trials.

Disease names:

Only the accepted disease names and units may be used, exactly as specified below:

MILDEW %	SEPTORIA NODORUM %	RHYNCHOSPORIUM %
YELLOW RUST %	SEPTORIA TRITICI %	NET BLOTCH %
BROWN RUST %	SEPTORIA AVENAE %	FUSARIUM EAR %
CROWN RUST %	SEPTORIA SPP %	SHARP EYESPOT DI
RAMULARIA %	BYMV %	BYDV %

D.2.7 **Recording methods**

Appropriate assessment keys are given in Appendix 11. All disease records to be sent to the Data Handling Operator as soon as they are made.

All disease data should be received by the Data Handling Operator by;

Winter barley and winter oats ***11 July***
Winter wheat, Triticale, Rye and Spelt wheat ***2 August***
Spring cereals ***16 August***

Data arriving after these dates, may not be included in the calculation of resistance ratings, will be stored in the database for future use.

If no disease assessments have been made on untreated trials during the period GS 60 (beginning of anthesis) to GS 80 (late milk/early dough), this fact should be recorded and a fax / email message giving this information sent to the Trials Organiser before the deadline for data receipt.

Where disease levels are very low, and the decision is taken to postpone an assessment until a later date please enter this information in the trial diary

D.3 Inoculated disease tests

The Pathology Trials Operator is responsible for conducting the tests according to these procedures.

D.3.1 Wheat

D.3.1.1 Yellow rust of wheat

Inoculated adult plant tests

NL varieties of winter and spring wheat, both sown in the autumn, together with control varieties of known resistance, are tested using mixed inoculum. Up to 4 isolates may be used in the nursery. Isolates are selected annually on UKCPVS advice to represent all important virulences / virulence combinations in the UK pathogen population.

WW NL1 and NL2 nurseries are combined, SW NL1 and NL2 should be combined in a separate trial. Control varieties which will indicate the presence of virulences in the isolates used should be included in each nursery, and these will be advised each year through UKCPVS. Each trial should contain spreader rows next to the candidate variety rows. Candidate rows should be approximately between 1m and 2m in length.

The spreader must be a known, universally susceptible variety, or mixture of varieties designed to maximise the duration of infectivity of the spreader.

Spreader rows within the trials are inoculated at about GS 30/31 with a spore mixture (in talc or other inert carrier) or infected transplants. Isolates must be increased separately and applied to the spreader rows as a mixture. In the case of spore/carrier mixtures, equal amounts of each isolate must be used in the mixture, and this should then be applied directly to the spreader rows. In the case of infected transplants, equal numbers of transplants for each isolate must be placed in the spreader rows at a sufficient density to ensure infection. Percent leaf area infection is assessed using the NIAB whole plot assessment key (Key No. 11, Anon 1985, Appendix 9) at 7-to-14-day intervals, starting when 10% of the varieties reach the 5% level of infection (usually 3 assessments).

D.3.1.2 Brown rust of wheat

Inoculated adult plant test

As for yellow rust (D3.1.1). Repeat inoculations may be employed as needed. Less than 3 assessments can be acceptable due to the late season nature of brown rust epidemics

D.3.1.3 Eyespot of wheat

Inoculated adult plant tests

NL2 varieties of winter wheat, together with susceptible and resistant control varieties, are tested in field trials, at two sites. There is no inoculated test at the NL1 stage.

A plot size of approximately 2 m x 1 m is used with 6 replications. Plots are inoculated at the 1st leaf stage by spreading infected oat grains over the plot. Samples of 20 tillers are assessed for eyespot symptoms once at around GS 75, depending on disease development, using an eyespot index key (Key No 12, Anon 1985, Appendix 11). Test plots are treated with fungicide to control non-target diseases

D.3.1.4 Wheat - additional VCU character tests

1) Soil-borne cereal mosaic virus

This is an additional VCU character, and the test is only performed for those varieties for which breeders claim resistance and make a request for the test. A resistance statement is provided after two years in tests (resistant/tolerant or susceptible). Winter wheat NL1 and NL2 varieties are sown in small plots (c. 0.5 m x 0.5 m; replicated twice) on a site/s known to be infected with Soil-borne Cereal Mosaic Virus. Plots are then assessed when symptoms are most pronounced, usually from early March onwards, as percentage of tillers infected.

Visual assessments on test varieties may be confirmed by ELISA tests if necessary.

2) Sharp eyespot

This is an additional VCU character, and the test is only performed for those varieties for which breeders claim resistance and make a request for the test. Seed of NL2 and NL1 varieties is mixed with oat grain inoculum of the pathogen and sown in 2 m^2 plots. Disease is assessed at both the seedling and adult plant stages, according to the degree of infection of the stem-base, using standard keys.

3) Fusarium ear blight

This is an additional VCU character and the test is only performed for those varieties for which breeders claim resistance and make a request for the test. Seed of NL2 and NL1 varieties is sown in small plots (2 m^2) and inoculated with a spore suspension of *F culmorum* (or a different species, if required) at anthesis. Infection is enhanced through the use of mist irrigation. Ear blight infection is assessed, using a pictorial key from GS80 onwards.

D.3.2 Barley

D3.2.1 No inoculated disease tests are carried out routinely.

D.3.2.2 Barley – additional character VCU tests

Barley mosaic viruses

This is an additional VCU character and the test is only performed for those varieties for which breeders claim resistance, and/or make a request for the test. A firm resistance statement is provided after two years in tests (resistant or susceptible). Winter barley NL1 and NL2 varieties are sown in small plots on sites known to be infected with either barley mild mosaic virus (BaMMV), barley yellow mosaic virus (BaYMV1), or the resistance-breaking strain of barley yellow mosaic virus (BaYMV2). Plots are then assessed when symptoms are most pronounced, in February/March, on a 1-5 scale, as detailed below:

no infection
few tillers with symptoms
up to 25% tillers with symptoms
up to 50% tillers with symptoms
between 50 and 100% tillers with symptoms
100% tillers with symptoms

Barley yellow dwarf virus (BYDV)

This is an additional VCU character and the test is only performed at the breeder's specific request. Spring barley NL1 and NL2 varieties are drilled late (c. mid-May), in two locations: NIAB HQ and NIAB Harper Adams. The aim is for the plants to be at the vulnerable seedling stage at the peak of aphid numbers. Plots are assessed for percentage leaf area affected by yellowing, caused by BYDV, at 7-to-14-day intervals, on a whole plot basis.

D.3.3 Oats

No inoculated disease tests are carried out on winter or spring oats.

D.3.4 Triticale

No inoculated disease tests are carried out on triticale.

D.3.5 Rye

No inoculated disease tests are carried out on rye.

D.3.6 Spelt wheat

No inoculated disease tests are carried out on spelt wheat.

Section E – Quality testing procedures

E.1 Responsibilities

E.1.1 The Quality Testing Operators appointed by the Trials Organiser are responsible for conducting approved quality tests according to these procedures.

E.2 Quality assessment methodology for obligatory and additional tests

E.2.1 Preparation of samples prior to quality analysis

Samples should be:

- relatively weed free
- free from excessive numbers of broken grains
- bright and of good colour
- well filled and free from visual sprouting.

E.2.1.2 Sample cleaning

The samples should be cleaned to remove combining debris such as straw, chaff, unthreshed ears and weed seeds. The cleaning may be by hand or with hand-held or mechanical sieves. If sieves are used, the following bottom screen sizes should be used: Wheat, triticale and rye: 2.0 mm bottom. Barley: 2.2 mm bottom. Husked Oats: 2 mm bottom. Naked Oats: 1.8 mm bottom. The top screen size should be of a suitable size to remove unthreshed ears, panicles and large debris. Grain passing through the 2mm sieve is weighed and used to calculate the sieving fraction. All further testing (specific weight and Kernel Content) to be carried out on the cleaned samples (i.e. with small grain removed).

E.2.2 **Quality tests**

E.2.2.1 **SPECIFIC WEIGHT**

(OBLIGATORY – wheat/barley)
(OBLIGATORY – triticale)
(OBLIGATORY – rye)
(OBLIGATORY – spelt wheat)
(OBLIGATORY – oats)

This can be determined using a chondrometer, Dickey-John analyser or by approved NIR methodology.

E.2.2.1.1 **Chondrometer**

The chondrometer has two compartments divided by a slide. The lower compartment is of a known fixed volume (usually 1 litre) and is removable. The upper compartment has greater capacity.

The slide is put in place while the upper chamber is filled with grain. The slide is then removed quickly, allowing the lower compartment to fill after which the slide is re-inserted. The weight of grain trapped in the lower compartment is measured and converted into kg/hl using conversion tables.

E.2.2.1.2 **Dickey-John analyser**

The Dickey-John analyser must be used according to the manufacturer's instructions. The instrument must be calibrated annually and possess a current ‘Certificate of Calibration’.

E.2.2.1.3 **NIR method**

The NIR method is permitted for the measurement of specific weight provided that the instrument uses current UK NIR Network calibrations for the appropriate crops. The operator must also participate in the monthly ring checks for the various calibrations being used to demonstrate that the instrument and operating practices are performing within specification. Records of the results of the monthly ring checks should be available for inspection if required.

E.2.2.1.4 **Correction of specific weight data for moisture content**

In the case of wheat, adjustment has to be made to the kg/hl value to take account of moisture content. The calculation procedure for this is as follows:

Add 0.35 kg/hl for each 1% moisture above 15%.

Subtract 0.35 kg/hl for each 1% below 15%.

In the case of barley and oats, no adjustment should be made to the kg/hl value to take account of moisture content.

E.2.2.2 **KERNEL CONTENT OF (CONVENTIONAL) OATS (OBLIGATORY) (%) (KER)**

E.2.2.2.1 Each grain sample tested should be in good condition, having been stored at 15% moisture content and cleaned as in E.2.1.

E.2.2.2.2 Simplified hand method.

E.2.2.2.3 Prior to kernel content determination, remove any free groats from the sample. The bulk sample must be thoroughly mixed and divided by quartering until two 10 g samples are obtained. Any material other than grain and husk should be removed and discarded.

Any free grains found in each sample should be extracted, weighed and discarded. If the free grain content of the sample is more than 1% of the total, by weight, a note should be taken.

5g of good oats should be retained from each sample for manual de-hulling. The remainder of the sample should be set aside.

Each sub-sample should be de-hulled by applying pressure to the base of each grain with the thumb/finger or tweezers. The good kernels and husks should be placed in separate containers and then weighed. The mean kernel and husk weights should then be calculated.

If the weight of kernel and husk obtained from the two sub-samples differs by more than 1%, then a further sub-sample should be drawn from the original bulk and de-hulled. If this is necessary, the final percentage of kernel should be the mean of the three results.

The mean percentage of kernel in the samples should be calculated thus:

$$\frac{\text{Mean weight of kernel (g)}}{\text{Total mean weight of kernel and husk (g)}} \times 100$$

The data should be recorded as KERNEL CONTENT%

E.2.2.2.4 Mechanical method

E.2.2.2.5 Prior to kernel content determination, remove any free groats from the sample. Two sub samples per variety are de-hulled. The 'fresh' (air-dry) sample is thoroughly mixed and divided by halving until two 25 g samples are obtained (one for de-hulling and a spare if needed for checking). Any material other than grain and husk is removed and discarded.

The sample is de-hulled for 2 minutes in the Streckel & Schrader impact de-huller Model Bt 459e at 6 bar and aperture 50% open (for further details see White, McGarel and Ardies (2000) Plant Varieties and Seeds 13, 45-59). After de-hulling separate the de-hulled sample and remove any hulls and un-hulled grain. Check the remaining kernel fraction for broken kernels and include them in the kernel fraction. Weigh the kernel fraction. Kernel yield is the weight of the kernel fraction expressed as a percentage of the initial 25 g sample minus weight of un-hulled grain.

The data should be recorded as KERNEL YIELD%.

E.2.2.3 *PROTEIN CONTENT DETERMINATION (ADDITIONAL) (%)*

E.2.2.3.1 <u>Hammer milling of grain prior to analysis</u>

The mill must be a hammer mill fitted with a 1 mm screen. 300 g of sample is milled and the material must be totally removed from the receptacle. The sample must be spread thinly, either with a printer's roller or with a wide blade spatula. The sample must be re-formed into a pile and the process repeated four times. After mixing, a representative sub-sample must be taken in the following manner: -

A sample jar of 250 ml capacity should be filled in small stages re-mixing the bulk between stages and blending each stage within the jar.
The sample jar must be filled and then sealed with a close-fitting lid.

E.2.2.3.2 Determination of crude protein or total nitrogen content

Determination of Crude Protein or Total Nitrogen Content must be by a chemical method, recognised by competent authorities (IBD, AOAC, ISO, etc) and which makes direct measurement of nitrogen content. Alternately an approved NIR methodology can be used.

Methods acceptable to the National Authorities are currently, total nitrogen determined by the Kjeldahl method and total nitrogen using the Dumas method. These methods are only acceptable where instrumentation used is capable of analysing sample sizes greater than 0.5 g. Alternately an approved NIR methodology can be used, **for wheat only**, provided that the instrument uses current UK NIR Network calibration. The operator must also participate in the monthly ring checks for the various calibrations being used to demonstrate that the instrument and operating practices are performing within specification. Records of the results of the monthly ring checks should be available for inspection if required.

Quality assurance of the analytical procedures must include regular analysis of a suitable test material - for example, a sample of flour maintained for that purpose.

Systematic errors in Kjeldahl nitrogen analysis must be controlled by the inclusion of blank analyses and by the analysis of a suitable analytical standard (Ammonium Sulphate, Methionine in a suitable bulking agent) for which the nitrogen content is known.

Instrument drift in Dumas nitrogen must be controlled by standardisation against a suitable analytical standard (EDTA, Glycine), for which the nitrogen content is known.

E.2.2.4 *HAGBERG FALLING NUMBER (ADDITIONAL - Wheat, Rye and Spelt)*

A methodology recognised by the National Authorities must be used.

E.2.2.5 *ENDOSPERM TEXTURE (ADDITIONAL - Wheat, Rye and Spelt)*

A methodology recognised by the National Authorities must be used.

E.2.2.6 *BREAD MAKING QUALITY (ADDITIONAL - Wheat, Rye and Spelt)*

A methodology recognised by the National Authorities must be used.

E.2.2.7 *BISCUIT MAKING POTENTIAL (ADDITIONAL - Wheat, Rye and Spelt)*

A methodology recognised by the National Authorities must be used.

E.2.2.8 *HOT WATER EXTRACT (ADDITIONAL - Barley)*

Hot Water Extract must be determined as described in the Recommended Methods of Analysis published by the Institute of Brewing, 1986 revision 2,2.4., 15-18.

The method describes 2 settings for the Buhler-Miag mill. Only the coarse grind setting at 0.7mm is to be used.

E.2.2.9 **SIEVING FRACTION (OBLIGATORY - Oats)**

Previously cleaned grain, with large debris and weed seed removed, is passed over a sieve 1.8 mm for naked oats, 2 mm for oats. The % of grain remaining on the sieve is recorded.

E.2.2.10 *THOUSAND GRAIN WEIGHT (ADDITIONAL)*

The weight of a representative 1000 grains at 85% dry matter from a cleaned grain sample is recorded.

Section F – Trial design and data handling

F.1 Plan validation and storage

F.1.2 After the trial has been drilled, the Growing Trial Operator must:

a) Confirm that the trial has been drilled according to plan and provide the sowing date, by returning site data 1 and associated trial sketch to the Trials Organiser who will send to appropriate Data Handling Operator.

b) If any amendments to the plan have been made, return a hard copy of the plan with any amendments clearly indicated to the Trials Organiser who will send to appropriate Data Handling Operator. Alternatively, amendments may be notified electronically with the agreement of the Data Handling Operator.

F.1.3 The Data Handling Operator will check these for statistical validity.

F.2 Data recording

F.2.1 Data are recorded using the methods and characters given in Sections C, D and E.

F.2.2. Site information is recorded for each trial including, for example, data on previous cropping, seed rates, soil details and fertiliser applications.

F.2.3 Details of any agrochemical applications are also recorded and retained by the Growing Trial Operator.

F.3 Other tests and trials

F.3.1 Any additional or alternative designs required for the assessment of additional VCU characters not detailed in Appendix 3 of the **VCU TRIAL PROTOCOL** for cereals (wheat, barley, oats, triticale, rye and spelt wheat), will be added to these **Procedures** as and when approved by the NLSC.

Supporting Document for Appendices

Appendices for this main procedure are stored in a separate document, which is updated closer to the start of the growing trial to include the latest information on controls and trial organisers. This will be published on VCU protocols and procedures for testing agricultural crops - GOV.UK (www.gov.uk).

This publication is available at www.gov.uk/government/publications

Any enquiries regarding this publication should be sent to us at

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www.gov.uk/apha

The Animal and Plant Health Agency (APHA) is an executive agency of the Department for Environment, Food & Rural Affairs, and also works on behalf of the Scottish Government and Welsh Government.