



Animal &  
Plant Health  
Agency

# United Kingdom Variety List Trials: Trial Procedures for Official Examination of Value for Cultivation and Use (VCU) Harvest 2023

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

August 2023

# Changes to Procedures

- Update to fungicides approved.
- Plant growth regulator update approved
- Year updated to 2023 on all relevant sections
- C.3.2.1: For operators using seed counters a formula can be used to calculate required seed numbers per plot.
- C.5.3.2 Moisture content samples details updated

## Contents

Section A – General information .....	5
A.1 Purpose .....	5
A.2 Scope .....	5
A.3 Responsibilities.....	5
A.4 Summary of growing trials, tests and assessments procedures .....	7
Section B – Seed handling procedures .....	18
B.1 Responsibilities.....	18
B.2 Seed handling procedures.....	18
B.3 Authentication of VCU seed .....	18
Section C – Growing trial procedures.....	20
C.1 Responsibilities.....	20
C.2 Site suitability .....	20
C.3 Sowing the trial.....	20
C.4. Husbandry .....	22
C.5 Harvesting.....	24
C.6 Records.....	26
Section D – Disease testing procedures .....	31
D.1 Assessment of natural infection .....	31
D.2 Naturally occurring disease in VCU growing trials.....	31
D.3 Inoculated disease tests.....	35
Section E – Quality testing procedures .....	38
E.1 Responsibilities.....	38
E.2 Quality assessment methodology for obligatory and additional tests.....	38
Section F – Trial design and data handling .....	42
F.1 Plan validation and storage .....	42
F.2 Data recording .....	42
F.3 Other tests and trials .....	42
Appendix 1 – Approved Trial Organisers/ Operators for wheat, barley, oats, triticale, rye and spelt wheat.	43
Appendix 2 – Seed treatment products for use on NL trials.....	44
Appendix 3 – Seed dispatch deadline dates.....	45
Appendix 4 – Growing Trial Operators and trial locations .....	46
1 Growing Trial Operators/Seed Handling Operators .....	46
2. Pathology Trials Operator.....	48
Appendix 5 – Control varieties for VCU assessments.....	49
Appendix 6 – Plant growth regulator protocol for cereal variety trials - 2023 .....	50
Appendix 7 – Fungicide protocol for cereal variety trials – 2023.....	57

Winter wheat.....	59
Winter wheat.....	61
Spring wheat - autumn sown .....	65
Spring wheat - spring sown. ....	67
Winter barley.....	68
Spring barley.....	70
Winter oats.....	72
Spring oats.....	74
Winter rye & triticale.....	75
Spring triticale.....	76
Recommended List Fungicide and PGR Ag Chem product labels.....	77
Appendix 8 – Moisture content determination for yield .....	78
1 Oven method.....	78
2 Electronic moisture assessment (moisture analysers) .....	79
3 NIR determination .....	80
Appendix 9 – Dates by which records should be submitted .....	81
1 To Trials Organiser.....	81
2 Plot records to Data Handling Operator.....	81
3 Plot samples to Quality Testing Operator .....	81
Appendix 10 – Growth stages of cereals .....	82
Appendix 11 – Assessment keys for cereal diseases .....	84
Ear Blight of wheat ( <i>Fusarium</i> Spp.).....	88
Wheat glume blotch ( <i>Septoria nodorum</i> Berk.) .....	89

# 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](mailto: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

Observation	Reference	Description of assessment - Obligatory	Description of assessment – Additional (Assessed only if requested by applicant.)
Yield	Section C	<b>Plot yield (treated)</b> <b>Plot yield (untreated) (WW only)</b> <b>Moisture content (treated)</b> <b>Moisture content (untreated) (WW only)</b>	
Behaviour with respect to factors in the physical environment.	Section C	<b>Lodging (treated)</b> <b>Lodging (untreated) (WW only)</b> <b>Leaning (treated)</b> <b>Leaning (untreated) (WW only)</b>	<i>Ripening date</i> <i>Straw length</i>

<b>Resistance to harmful organisms</b>	Section D	<b>Mildew</b> <b>Yellow rust</b> <b>Brown rust</b> <b>*Septoria tritici</b> <b>*Septoria nodorum (WW ONLY)</b> <b>Eyespot (inoculated test only)</b> <b>Fusarium ear blight</b>	<i>Sharp eyespot (inoculated test only)</i> <i>Fusarium (inoculated test only)</i> <i>Soil Borne Wheat Mosaic Virus</i>
<b>Quality characteristics (Laboratory tests)</b>	Section E	<b>Specific weight</b>	<i>Protein content</i> <i>Hagberg falling number</i> <i>Endosperm texture</i> <i>Bread making quality</i> <i>Biscuit making quality</i> <i>Thousand grain weight</i>

\*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	<b>Plot yield (treated)</b> <b>Plot yield (untreated)</b> <b>Moisture content (treated)</b> <b>Moisture content (untreated)</b>	
Behaviour with respect to factors in the physical environment.	Section C	<b>Lodging (treated)</b> <b>Lodging (untreated)</b> <b>Leaning (treated)</b> <b>Leaning (untreated)</b> <b>Ear loss</b>	<i>Ripening date</i> <i>Straw length</i>
Resistance to harmful organisms	Section D	<b>Mildew</b> <b>Yellow rust</b> <b>Brown rust</b> <b>Rhynchosporium</b> <b>Net blotch (WB only)</b>	<i>Ramularia</i>
Quality characteristics (Laboratory tests)	Section E	<b>Specific weight</b>	<i>Hot water extract (HWE)</i> <i>Thousand grain weight</i> <i>Nitrogen content</i>

**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	<b>Plot yield treated and untreated</b> <b>Plot yield (fungicide without plant growth regulator) (SO only)</b> <b>Moisture content treated and untreated</b>	
Behaviour with respect to factors in the physical environment.	Section C	<b>Lodging treated and untreated</b> <b>Leaning treated and untreated</b>	<i>Ripening date</i> <i>Straw length</i>
Resistance to harmful organisms	Section D	<b>Mildew</b> <b>Crown rust</b>	<i>Septoria avenae</i>
Quality characteristics (Laboratory tests)	<i>Section E</i>	<b>Kernel content</b> <b>Specific weight</b> <b>Sieving fraction</b>	<i>Protein content</i> <i>Thousand grain weight</i>

**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	<b>Plot yield (treated)</b> <b>Moisture content (treated)</b>	
Behaviour with respect to factors in the physical environment.	Section C	<b>Lodging (treated)</b> <b>Leaning (treated)</b>	<i>Ripening date</i> <i>Straw length</i>
Resistance to harmful organisms	Section D	<b>Mildew</b> <b>Yellow rust</b> <b>Brown rust</b> <b>*Septoria tritici</b>	
Quality characteristics (Laboratory Tests)	Section E	<b>Specific weight</b>	<i>Protein content</i> <i>Thousand grain weight</i>

\*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	<b>Plot yield (treated)</b> <b>Moisture content (treated)</b>	
Behaviour with respect to factors in the physical environment.	Section C	<b>Lodging (treated)</b> <b>Leaning (treated)</b>	<i>Ripening date</i> <i>Straw length</i>
Resistance to harmful organisms	Section D	<b>Mildew</b> <b>Brown rust</b> <b>*Septoria tritici</b>	
Quality characteristics (Laboratory Tests)	Section E	<b>Specific weight</b>	<i>Protein content</i> <i>Hagberg falling number</i> <i>Endosperm texture</i> <i>Bread making quality</i> <i>Biscuit making quality</i> <i>Thousand grain weight</i>

\*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	<b>*Plot yield</b> <b>Moisture content (managed)</b>	
Behaviour with respect to factors in the physical environment.	Section C	<b>Lodging (managed)</b> <b>Leaning (managed)</b>	<i>Ripening date</i> <i>Straw length</i>
Resistance to harmful organisms	Section D	<b>Mildew</b> <b>Yellow rust</b> <b>Brown rust</b> <b>*Septoria tritici</b>	
Quality characteristics (Laboratory Tests)	Section E	<b>Specific weight</b>	<i>Protein content</i> <i>Hagberg falling number</i> <i>Endosperm texture</i> <i>Bread making quality</i> <i>Biscuit making quality</i> <i>Thousand grain weight</i>

\*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)**

# 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<sup>2</sup> per replicate for trials with two replications and 15 m<sup>2</sup> per replicate for trials with 3 or 4 replications. For untreated trials the harvest plot must be not less than 15 m<sup>2</sup> 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, ie the final plant population per m<sup>2</sup> 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.

Crop	Population plants/m <sup>2</sup> for England and Wales	Population plants/m <sup>2</sup> for Scotland and Northern 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)	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:-

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

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:

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

### 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](https://www.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; eg 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 60°C 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 using a system approved by the Trials Organiser or recorded on paper then entered and validated onto a computer using an approved system. 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<sup>2</sup> 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. Eg

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<sup>2</sup> 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<sup>2</sup> 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<sup>2</sup> 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 over-ripe 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
<i>Mildew</i>	MIL	√	√	√	√	√	√	√	√	√
<i>Yellow rust</i>	YR	√	√	√	√			√		√
<i>Brown rust</i>	BR	√	√	√	√			√	√	√
<i>Septoria nodorum*</i>	SEPN	√								
<i>Septoria tritici*</i>	SEPT	√	√					√	√	√
<i>Rhynchosporium</i>	RHYN			√	√					
<i>Net blotch</i>	NB			√						
<i>Crown rust</i>	CR					√	√			
<i>Fusarium ear blight</i>	FEB	√								
<i>Septoria avenae</i>	SEPA					√	√			
<i>Ramularia**</i>	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 ie 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, ie 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;

<b>Winter barley and winter oats</b>	<b>11 July</b>
<b>Winter wheat, Triticale, Rye and Spelt wheat</b>	<b>2 August</b>
<b>Spring cereals</b>	<b>16 August</b>

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<sup>2</sup> 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<sup>2</sup>) 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 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 Hammer milling of grain prior to analysis

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 (ADDITIONAL - 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/wheat and 2.5 mm for barley. 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 and, once this has been done, will load the plan on the database.

## 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.

## Appendix 1 – Approved Trial Organisers/ Operators for wheat, barley, oats, triticale, rye and spelt wheat.

Activity	Organisers/Operators Responsible
Data Handling Operators	BioSS* AHDB Cereals and Oilseeds** NIAB***
Trials Organiser	BSPB
Pathology Trials Operator	NIAB
Trial Inspection and Technical Validation Operator	AHDB Cereals and Oilseeds and SASA
Quality Testing Operators	NIAB and Campden BRI
Data Review and Standards Setting Operator	NIAB

\*Wheat, Barley, Oats

\*\*Triticale, Rye

\*\*\* Spelt wheat

## Appendix 2 – Seed treatment products for use on NL trials

Where there are alternative treatments, all varieties in the trial must be treated with the same product

Crop	Treatment
<b>Winter wheat</b>	Prothioconazole + Tebuconazole (Redigo Pro) Kinto Plus (Fluxapyroxad, Triticonazole and Fludioxonil) may be used
<b>Winter barley</b>	Prothioconazole + Tebuconazole (Redigo Pro). Raxil Star. Kinto Plus (Fluxapyroxad, Triticonazole and Fludioxonil) may be used
<b>Winter oats</b>	Prothioconazole + Tebuconazole (Redigo Pro). Kinto Plus (Fluxapyroxad, Triticonazole and Fludioxonil) may be used
<b>Spring wheat</b>	Prothioconazole + Tebuconazole (eg Redigo Pro)
<b>Spring barley</b>	Prothioconazole + Tebuconazole (Redigo Pro)
<b>Spring oats</b>	Prothioconazole + Tebuconazole (Redigo Pro)
<b>Winter Triticale</b>	Prothioconazole + Tebuconazole (Redigo Pro) Kinto Plus (Fluxapyroxad, Triticonazole and Fludioxonil) may be used
<b>Rye</b>	Prothioconazole + Tebuconazole (Redigo Pro) Kinto Plus (Fluxapyroxad, Triticonazole and Fludioxonil) may be used
<b>Spelt wheat</b>	No Treatment

## Appendix 3 – Seed dispatch deadline dates

VCU seed must be delivered to each Growing Trials Operator/ Seed Handling Operator by:

Winter wheat	15 <sup>th</sup> September
Triticale	1 <sup>st</sup> September
Rye	1 <sup>st</sup> September
Spelt wheat	1 <sup>st</sup> September
Winter barley	8 <sup>th</sup> September
Winter oats	15 <sup>th</sup> September
Spring wheat	23 <sup>rd</sup> October
Spring barley	15 <sup>th</sup> January
Spring oats	15 <sup>th</sup> January

# Appendix 4 – Growing Trial Operators and trial locations

## 1 Growing Trial Operators/Seed Handling Operators

### A WINTER WHEAT

Growing Trial Operator	Seed Handling Operator (if not Trial Operator)	Location of trial	Trial description
Saaten Union UK Ltd		Wold Newton, Lincolnshire	T and UnT
NIAB		Terrington Norfolk	T only
NIAB		Callow, Herefordshire	T and UnT
Elsoms Wheat Ltd		Spalding, Lincolnshire	T, UnT and L
KWS UK Ltd		Framlingham, Suffolk	T and UnT
KWS UK Ltd		Frisby on the Wreak, Leicestershire	T and L
RAGT Seeds Ltd		Ickleton, Cambridgeshire	T only
Agrii		Great Dunmow, Essex	T only
Limagrain UK Ltd		Elmswell, Bury St Edmunds, Suffolk	T only
Syngenta Ltd		Horncastle, Lincolnshire	T only
Envirofield		Wallingford, Oxfordshire	T only
NIAB		Broughton, Hampshire	T only
NIAB		Petham, Kent	T only
Frontier Agriculture Ltd	Saaten Union	Driffield, Yorkshire	T only
SRUC	NIAB	Humbie, East Lothian	T, UnT and L
DSV UK Ltd		Wardington, Banbury, Oxon	T only
Scottish Agronomy		Tayside, Angus	T and UnT

### B SPRING WHEAT

Growing Trial Operator	Seed Handling Operator (if not Trial Operator)	Location of trial	Trial description
Saaten Union UK Ltd		Cowlinge, Suffolk	T and DOP
John Innes Enterprise		Norwich, Norfolk	T and DOP
KWS UK Ltd		Fowlmere, Cambridgeshire	T and DOP
NIAB		Sutton Scotney, Hampshire	T only
Stockbridge Technology Centre	Saaten Union	Cawood, North Yorkshire	T only
Frontier Agriculture		Bleasby, Lincolnshire	T only

### C WINTER BARLEY

Growing Trial Operator	Seed Handling Operator (if not Trial Operator)	Location of trial	Trial description
Agrii		Great Dunmow, Essex	T only
Saaten Union UK Ltd		Cowlinge, Suffolk	T only
KWS UK Ltd		Fulbourn, Cambridgeshire	T only
Syngenta Ltd		Great Sturton, Lincolnshire	T and UnT
Scottish Agronomy		Balgonie, Fife	T and UnT
Envirofield		Wimborne, Dorset	T and UnT
NIAB TAG		Callow, Herefordshire	T and UnT
Frontier Agriculture	Saaten Union	Driffield, Yorkshire	T only
SRUC	NIAB	Edinburgh	T and UnT
SRUC	NIAB	Ellon, Aberdeenshire	T and UnT

## D SPRING BARLEY

Growing Trial Operator	Seed Handling Operator (if not Trial Operator)	Location of trial	Trial description
KWS UK LTD		Fulbourn, Cambridgeshire	T only
NIAB TAG		Morley, Norfolk	T only
Scottish Agronomy		Gateside, Nr Kinross	T and UnT
Syngenta Ltd		Great Sturton, Lincolnshire	T and UnT
Stockbridge Technology Centre	Saaten Union	Cawood, North Yorkshire	T only
Scottish Agronomy		Hill of Fearn, Tain	T only
Trials Force	Agrii	Steelstrath, Aberdeenshire	T and UnT
NIAB		Andover, Hants	T and UnT
Trials Force	Agrii	Cullen, Banffshire	T only
SRUC	Agrii	Humbie, East Lothian	T only
Scottish Agronomy		Tayside, Angus	UnT only
AFBI	Agrii	Crossnacreevy	T and UnT

## E WINTER OATS

Growing Trial Operator	Seed Handling Operator (if not Trial Operator)	Location of trial	Trial description
Agrii		Great Dunmow, Essex	T only
Scottish Agronomy		Balgonie, Fife	T and U
NIABTAG		Callow, Herefordshire	T and U
NIABTAG		Hampshire	T only

## F SPRING OATS

Growing Trial Operator	Seed Handling Operator (if not Trial Operator)	Location of trial	Trial description
Scottish Agronomy		Fife	T and UnT
Saaten Union		Cowlinge, Suffolk	T and UnT
NIAB		Callow Herefordshire	T only
SRUC	NIABSHU	Aberdeenshire	T and UnT
AFBI	Agrii	Crossnacreevy	T and UnT

## G WINTER RYE

Growing Trial Operator	Seed Handling Operator (if not Trial Operator)	Location of trial	Trial description
Saaten Union UK Ltd		Cowlinge, Suffolk	T and UnT

## H SPRING RYE

Growing Trial Operator	Seed Handling Operator (If not Trial Operator)	Location of trial	Trial description
Saaten Union UK Ltd		Cowlinge, Suffolk	T only

## I WINTER TRITICALE

Growing Trial Operator	Seed Handling Operator (if not Trial Operator)	Location of trial	Trial description
Saaten Union UK Ltd		Cowlinge, Suffolk	T only

## J SPRING TRITICALE

Growing Trial Operator	Seed Handling Operator (if not Trial Operator)	Location of trial	Trial description
Saaten Union UK Ltd		Cowlinge, Suffolk	T only

## 2. Pathology Trials Operator

Pathology Trials Operator	Location of trial
NIAB	UK



## Appendix 5 – Control varieties for VCU assessments

The Control varieties are:

Crop	Control Varieties
<b>Winter wheat</b>	LG Skyscraper (Feed) Gleam (Feed) Skyfall (Bread making) KWS Barrel (Biscuit making) KWS Extase (Bread making) LG Astronomer (Additional control)
<b>Winter barley</b>	Craft (Malting) KWS Feeris (6 row Feed) SY Kingsbarn (6 row Feed) Electrum (Malting) KWS Tardis (Feed)
<b>Winter oats</b>	RGT Southwark Mascani Dalguise Grafton (Comparator) – naked oat
<b>Winter rye</b>	SU Performer
<b>Winter triticale</b>	KWS Fido Kasyno
<b>Spelt wheat</b>	Zollernspelz Zollermit
<b>Spring wheat</b>	Mulika KWS Cochise Hexham
<b>Spring barley</b>	SY Tungsten Propino RGT Planet LG Diabo Laureate Skyway
<b>Spring oats</b>	Canyon WPB Isabel Aspen Lennon
<b>Spring rye</b>	SU Vergil Ovid
<b>Spring triticale</b>	Doublet Trimour

# Appendix 6 – Plant growth regulator protocol for cereal variety trials - 2023

Last updated: February 2022

Recommendations by Paul Gosling, BASIS registration number R/E/8107/IFM.

RL Trials Co-ordinator: Mark Bollebakker 01480 482989  
 NL Co-ordinator: Jeremy Widdowson 01353 653846

The following notes are given for guidance in the use of plant growth regulators (PGRs) on Recommended List trials. The full manufacturer instructions should be consulted prior to the storage, handling or use of any agrochemical product. The instructions and advice given on product labels should be followed at all times. There should be no conflicting advice between that given in this protocol and on the product label; if there appears to be any conflict, inform the Trials Co-ordinators before the application is made.

Table 1: Summary of applications for NL trials

Crop	Fungicide treated plots	Plots or DOP's without fungicide	Lodging trials
Winter wheat	YES	NO	NO
Spring wheat (late autumn or spring sown)	YES	NO	N/A
Winter barley	YES, UNLESS THE CROP IS STRESSED AND THE RISK OF LODGING IS NEGLIGIBLE.	YES, UNLESS THE CROP IS STRESSED AND THE RISK OF LODGING IS NEGLIGIBLE.	NO
Spring barley	Only if a high risk of lodging	NO	NO
Winter oats	YES, +F/+PGR PLOTS ONLY.	N/A	NO
Spring oats	YES, +F/+PGR PLOTS ONLY.	NO	N/A
Winter rye	YES	YES	N/A
Winter triticale	YES	YES	N/A

Plant growth regulators should not be applied to trials grown specifically for the assessment of lodging. There are important restrictions relating to the use of plant growth regulators.

Crop damage can occur if manufacturers' guidelines are not followed.

Common restrictions are those relating to crops that:

- are sited on soils of low fertility
- are suffering from herbicide damage
- are under stress from drought, waterlogging or any other cause
- were sown in the very late spring

Trial managers should consult the manufacturer's instructions to see if any of these restrictions apply.

**IN ALL CASES, PLANT GROWTH REGULATOR SHOULD BE APPLIED TO DESIGNATED PLOTS ONLY AS SPECIFIED IN THE AHDB RECOMMENDED LIST CEREAL TRIALS PROTOCOL**

**General guidance and notes specific to the use of PGRs on variety trials**

Products should be used according to current manufacturers' instructions. It is the responsibility of the Trial Manager to ensure that the growth stages of all of the varieties in the trial are within the manufacturer's guidelines for use. The following notes are intended to highlight matters of particular relevance to the use of PGR products on variety trials and timings are relevant to earliest varieties.

The **Terpal** doses in this protocol are below full rate (**2.0 l/ha**).

Consult the Trials Co-ordinators if you feel that a higher dose is needed e.g. if there is a risk of severe lodging. However, be aware that late applications of **Terpal** (e.g. at around the flag leaf emergence stage) at higher doses can lead to crop damage or stimulate the production of secondary tillers.

## Winter wheat and late autumn sown Spring wheat

Product	Crop	Rate & timing
Either split dose 3C Chlormequat 750+ Moddus	Winter wheat only	3C Chlormequat 750 at 1.0 l/ha at G.S. 25 – 30 PLUS †Moddus at 0.1 l/ha if applied at the G.S 30 timing. Followed at G.S. 31 – 32 by 3C Chlormequat 750 at 1.0 l/ha PLUS †Moddus at 0.1 – 0.2 l/ha. Do not apply if any variety is beyond the G.S. 32 timing.
<u>OR SINGLE DOSE (Winter wheat and late sown autumn sown spring wheat) 3C Chlormequat 750 + Moddus</u>	Winter wheat	3C Chlormequat 750 at 1.5 – 2.0 l/ha at GS30 – 31 (in the North and North-west regions this can be delayed to GS32) PLUS †Moddus at 0.1 – 0.2 l/ha. Do not apply if any variety is beyond G.S. 32.
	Spring wheat	3C Chlormequat 750 at 1.25 l/ha at GS30 – 31 (in the North and North-west regions this can be delayed to G.S. 32) PLUS †Moddus at 0.1 – 0.2 l/ha. Do not apply if any variety is beyond G.S. 32.
*Terpal		Either single-dose of 0.75 – 1.5 l/ha (depending on lodging risk and *condition of the crop) at GS32 – 37 OR (particularly for the early sown crops) a split dose of 1.0 l/ha at GS33 plus 0.75 l/ha at GS37  Maximum individual dose is 2.0 l/ha, maximum total dose is 2.0 l/ha and maximum number of treatments is 2 per crop.

\*Terpal should not be applied to any variety in the trial if the leaf sheaths have split and the ears are visible.

- **DO NOT** apply Terpal if the crop is suffering from herbicide damage or physical stress caused by e.g., waterlogging, drought, take-all.
- **DO NOT** apply in temperatures above 21°C. If, in Winter wheat/Spring wheat trials there are large differences in growth stages; contact the RL Trials Co-ordinator/ NL Coordinator.

† Moddus - Apply unless the crop is stressed or the lodging risk is negligible.

## Spring sown Spring wheat trials

Product	Rate & timing
<b>3C Chlormequat 750 + Moddus</b>	Single half dose of 0.6 l/ha at GS 30 – 31. Consult the Trials Co-ordinator if the crop is late sown and/or under stress. Do not apply if any variety is beyond G.S. 31.

Terpal and Moddus should not be applied to spring sown Spring Wheat trials.

## Winter barley trials

Product	Rate & timing
<b>3C Chlormequat 750 + Moddus</b>	3C Chlormequat 750 at 1.5 – 2.0 l/ha at G.S. 25 – 30 PLUS †Moddus at 0.1 – 0.2 l/ha if applied at the G.S. 30 timing.
<b>Moddus</b>	Optional: G.S. 31 – 32 in high fertility situations (0.1 – 0.2 l/ha)
<b>Terpal</b>	0.75 – 1.0 l/ha at *G.S. 32 – 39

\*The preferred option for **Terpal** is for the product to be applied separately from the T2 application. Terpal should not be applied on any variety in the trial if the leaf sheaths have split and the ears are visible. Do **NOT** apply Terpal if the crop is suffering from herbicide damage or physical stress caused by e.g. waterlogging, drought, take-all. Do **NOT** apply in temperatures above 21°C.

† **Moddus**. Apply unless the crop is stressed or the lodging risk is negligible.

## Spring barley trials

Product	Rate & timing
<b>Moddus</b>	<i>Optional: Moddus may be applied at 0.1-0.2 l/ha at GS30 for increased rooting and tiller survival and where lodging may be expected</i>
<b>Terpal</b>	<i>Optional: Terpal 0.5 l/ha at GS32-37. Apply only if the risk of lodging is high and the crop shows no signs of stress.</i>

## Winter and Spring oat trials

Product	Rate & timing
<b>Moddus</b>	<i>Optional: Moddus at 0.1 – 0.2 l/ha, in high lodging risk situations and if applied at G.S. 30.</i>
<b>3C Chlormequat 750 Option for an <u>additional</u> Canopy in high-risk situations</b>	<p>Single dose: 3C Chlormequat 750 1.5 – 2.0 l/ha at G.S.31 – 32. A non-ionic wetting agent should be used - see product label.</p> <p><u>In high-risk situations Canopy 0.75 – 1.5 l/ha up to G.S. 41.</u></p>

Apply routinely as a single application to all appropriate trials unless it is felt that the application is inadvisable, in which case the Trials Co-ordinators should be consulted

## Winter rye & triticale trials

Product	Rate & timing
<b>3C Chlormequat 750</b>	Either single dose: 3C Chlormequat 750 at 1.0 l/ha PLUS †Moddus at 0.1 – 0.2 l/ha at G.S. 30
	Or (optional for rye) split dose: 3C Chlormequat 750 1.0 l/ha at G.S. 31 – 32 PLUS †Moddus at 0.1 – 0.2 l/ha
<b>Terpal</b>	Terpal 1.5 – 2.0 l/ha at G.S. 37 (use lower rate if crop is stressed). Or Medax Max 0.3 – 0.4 kg/ha should be used if Terpal timing is missed at G.S. 37. This is safe up to G.S. 49 and is safer for use on the ear in comparison to Terpal.

† Moddus. Apply unless the crop is stressed or the lodging risk is negligible

## Spring triticale (NL trial)

Product	Rate & timing
3C Chlormequat 750	Single dose: 3C Chlormequat 750 at 2.0 l/ha



# Appendix 7 – Fungicide protocol for cereal variety trials – 2023

Last updated: December 2020

Recommendations by Paul Gosling, BASIS registration number R\E\8107\IFM.

	Name	Telephone
<b>RL Trials Co-</b>	Mark Bollebakker	01480 482989
<b>NL Co-Ordinator:</b>	Jeremy Widdowson	01353 653846

This programme is for use on AHDB Recommended List and National List cereal trials in 2021/22:

- For spring and summer applications to trials for harvest 2022.
- For autumn applications to trials to be harvested in 2023

It is an experimental protocol and is designed to meet the protocol aim of keeping disease levels in treated plots below 5% infection in all varieties and in all trials. It is not intended to follow commercial practice.

Please note that most treatments are compulsory, and the rates and timings specified should be adhered to as closely as possible. The protocol is robust and, if applied correctly, should be effective. **If, however, disease levels rise above 5% (e.g., if weather conditions do not allow optimal application), please contact Mark Bollebakker (RL) or Jeremy Widdowson (NL) to discuss an appropriate course of action.**

Fungicides should be applied at the stated dose rates unless agreed otherwise with the RL Trials Co-ordinator or NL Co-ordinator. Changes to dose rates will only be sanctioned in exceptional circumstances, such as drought-stressed trials under low disease pressure.

Please contact the RL Trials Co-ordinator or NL Co-ordinator if you have any difficulty in sourcing a particular product.

In some cases, two or more products may be available from a company with the same active substances and formulation; if you wish to use such a product and it is not listed in this protocol, contact the RL Trials Co-ordinator or NL Co-ordinator. Generic products should be avoided as they may contain the same active substances but in a different formulation.

**Important:** Every care has been taken to ensure that all mixtures, rates, and timings are approved, meeting COSSH regulations and manufacturers and statutory guidelines. However, it is the responsibility of the Trial Manager to ensure that they meet all current regulations at the time of application. It is recommended to seek advice from a qualified BASIS advisor for suitability to local conditions and regulatory compliance. The RL Trials Co-ordinator or NL Co-ordinator should be notified of any conflict between the protocol and current regulations.

In accordance with FRAC guidelines, only two applications of strobilurin fungicides and two SDHI fungicides are to be applied to any crop.

Product	Active substances	Amount of active substance	Manufacturer
Comet 200	Pyraclostrobin	200 g/l	BASF
Cyflamid	Cyflufenamid	50 g/l	Certis
Elatus ERA	Benzovindiflupyr Prothioconazole	75 g/l    150 g/l	Syngenta
Entargo	Boscalid	500 g/l	BASF
Fandango	Fluoxastrobin Prothioconazole	100 g/l	Bayer CropScience
Imtrex	Fluxapyroxad	62.5 g/l	BASF
Arizona	Folpet	500 g/l	Adama
Proline 275	Prothioconazole	275 g/l	Bayer
Prosaro	Prothioconazole Tebuconazole	125 g/l    125 g/l	Bayer
Revystar XE	Mefentrifluconazole Fluxapyroxad	47.5/100 g/l	BASF
Siltra Xpro	Bixafen Prothioconazole	60/200g/l	Bayer
Sunorg-Pro	Metconazole	90g/l	BASF
Talius/Justice	Proquinazid	200 g/l	DuPont
Tebuconazole – Tebcur 250	Tebuconazole	250 g/l	Belchim/Rotam
Univoq	Fenpicoxamid Prothioconazole	50 g/l 100 g/l	Corteva

## Winter wheat

Treatment Timing	Growth Stage (G.S) Target timing	[Add header description]	Product a.i.	Rate
Before TO		Optional in autumn or early spring if rusts present	Monkey	1.5 l/ha
TO	G.S. 30 (no later than when 50% of varieties at G.S.30)		Cyflamid +	0.25-0.30 l/ha
TO	G.S. 30 (no later than when 50% of varieties at G.S.30)		Melcanazole +	0.5 l/ha
TO	G.S. 30 (no later than when 50% of varieties at G.S.30)		Comet 200	0.4-0.6 l/ha

T1 G.S.32 (with most varieties at G.S.32)

Treatment Timing	Growth Stage (G.S) Target timing	Disease	Product a.i.	Rate
T1	G.S.32	For eye spot situation	Revystar XE +	1.0 to 1.25 l/ha
T1	G.S.32	For eye spot situation	Entargo +	0.5 l/ha
T1	G.S.32	For eye spot situation	Phoeniz +	1.5 l/ha
T1	G.S.32	For eye spot situation	Talius/Justice	0.15 l/ha
T1	G.S.32	For heavy rust situation	Revystar XE +	1.0 to 1.25 l/ha
T1	G.S.32	For heavy rust situation	Elatus Era +	0.6 l/ha
T1	G.S.32	For heavy rust situation	Phoenix +	1.5 l/ha
T1	G.S.32	For heavy rust situation	Talius/Justice	0.15 l/ha

Treatment Timing	Growth Stage (G.S) Target timing	Note	Product a.i.	Rate
T1.5	G.S.33 (targeting leaf 2 emerging)		Tebuconazole	0.75 l/ha
T1.5	G.S.33 (targeting leaf 2 emerging)		Prothioconazol	0.6 l/ha

Note: 14 day interval between T1.5 Tebuconazole application and T2 application.

## Winter wheat

Contact Trials Manager if significant yellow rust pre T0.

### T0 G.S. 30 (with no later than when 50% of varieties at G.S.30)

Treatment Timing	Growth Stage (G.S.) - target timing or disease	Product / active ingredient	Rate
T0	G.S. 30	Cyflamid +	0.25 – 0.35 l/ha
T0	G.S. 30	Sunorg-Pro - Metconazole +	0.5 l/ha
T0	G.S. 30	Comet 200	0.4 – 0.6 l/ha

### T1 G.S. 32 (with most varieties at G.S. 32)

Treatment Timing	Growth Stage (G.S.) - target timing or disease	Disease	Product / active ingredient	Rate
T1	G.S. 32	For eye spot situation	Revystar XE +	1.0 – 1.25 l/ha
T1	G.S. 32	For eye spot situation	Entargo +	0.5 l/ha
T1	G.S. 32	For eye spot situation	Arizona +	1.0 l/ha
T1	G.S. 32	For eye spot situation	Talius/Justice	0.15 l/ha
T1	G.S. 32	For heavy rust situation	Revystar XE +	1.0 – 1.25 l/ha
T1	G.S. 32	For heavy rust situation	Elatus Era +	0.6 l/ha
T1	G.S. 32	For heavy rust situation	Arizona +	1.0 l/ha
T1	G.S. 32	For heavy rust situation	Talius/Justice	0.15 l/ha

Treatment Timing	Growth Stage (G.S.) - target timing or disease	Disease	Product / active ingredient	Rate
T 1.5	G.S. 33 (targeting leaf 2 emerging)	<i>Optional in a rust situation</i>  <i>Note: 14-day interval between T1.5 Tebuconazole application and T2 application</i>	<i>Tebuconazole</i>	<i>0.75 l/ha</i>
T 1.5	G.S. 33 (targeting leaf 2 emerging)	<i>Or in a Septoria</i>	<i>Prothioconazole</i>	<i>0.6 l/ha</i>
T 1.5	G.S. 33 (targeting leaf 2 emerging)	<b><i>Note: Arizona can only be used at one timing either here or at T3</i></b>	<i>+ Arizona</i>	<i>1.0 l/ha</i>

Treatment Timing	Growth Stage (G.S.) - target timing or disease	Disease	Product / active ingredient	Rate
T2	G.S 39 – 45 and no later than 4 weeks after T1 application		Univoq	1.25 – 1.5 l/ha
T2	G.S 39 – 45 and no later than 4 weeks after T1 application	Note: <u>Strongly</u> recommended for rust in East and Southern regions.	Tebuconazole +	0.75 – 1.0 l/ha
T2	G.S 39 – 45 and no later than 4 weeks after T1 application		Arizona	1.0 l/ha
T2	G.S 39 – 45 and no later than 4 weeks after T1 application	<i>Optional - If mildew established</i>	<i>Cyflamid</i>	<i>0.25 – 0.35 l/ha</i>

Treatment Timing	Growth Stage (G.S.) - target timing or disease	Disease	Product / active ingredient	Rate
<b>T3</b>	G.S. 55 – 61 Timing for Fusarium control (very early anthesis preferred).		Prosaro +	0.8 – 1.0 l/ha
<b>T3</b>	G.S. 55 – 61 Timing for Fusarium control (very early anthesis preferred).		Comet 200 +	0.4 – 0.6 l/ha
<b>T3</b>	G.S. 55 – 61 Timing for Fusarium control (very early anthesis preferred).	<i>Optional - if not used at T1.5 can only be used up to GS59.</i>	Arizona	1.0 l/ha

### Post T3

For extreme septoria or brown rust situations please contact the relevant trials co-ordinator

Note: No more than two applications of a SDHI product should be applied to any cereal crop.

Depending whether "Knock down" or protectant activity is required, applications of Cyflamid (eradicator) and Talius/Justice (protectant) can be swapped at T0 or T1.

Do not apply consecutive applications of products containing Cyflamid.

For Cyflamid, the maximum number of treatments is two per crop on all recommended cereals, to be applied only in spring.

### Pre T1

For disease infections before G.S. 29 consult the relevant trials co-ordinator.

Treatment Timing	Growth Stage (G.S.) - target timing	Product / active ingredient	Rate
<b>T1</b>	G.S. 29 – 31	Revystar XE +	1.0 – 1.25 l/ha
<b>T1</b>	G.S. 29 – 31	Comet 200 +	0.4 – 0.6 l/ha
<b>T1</b>	G.S. 29 – 31	Arizona +	1.0 l/ha
<b>T1</b>	G.S. 29 – 31	Talium/Justice	0.15 l/ha

Treatment Timing	Growth Stage (G.S.) - target timing	Disease	Product / active ingredient	Rate
<b>T2</b>	G.S. 37 and no later than 3 weeks after T1 application		Revystar XE +	1 – 1.25 l/ha
<b>T2</b>			Arizona	1.0 l/ha

<b>T2</b>		<i>Optional if mildew established</i>	<i>Cyflamid</i>	<i>0.25 – 0.5 l/ha</i>
-----------	--	---------------------------------------	-----------------	------------------------

<b>Treatment Timing</b>	<b>Growth Stage (G.S.) - target timing</b>	<b>Disease</b>	<b>Product / active ingredient</b>	<b>Rate</b>
<b>T3</b>	G.S. 51 – 61		Prosaro +	0.8 l/ha
<b>T3</b>	G.S. 51 – 61		Comet 200 +	0.4 – 0.6 l/ha
<b>T3</b>	G.S. 51 – 61	<i>If including Arizona, must not exceed G.S. 59</i>	<i>Arizona</i>	<i>1.0 l/ha</i>

**When you are applying optional treatments make sure you adhere to Product Labels regarding maximum total dose and maximum number of treatments.**



## Spring wheat - autumn sown

### Before T0

For disease infections before G.S. 29 consult the relevant trials operator.

### T1

Treatment Timing	Growth Stage (G.S.) Target timing or disease.	Disease	Product/ a.i.	Rate
T1	G.S. 29 - 31	<b>For heavy rust situation</b>	Elatus Era +	0.6 l/ha
T1	G.S. 29 - 31	<b>For heavy rust situation</b>	Revystar XE +	1.0 to 1.25 l/ha
T1	G.S. 29 - 31	<b>For heavy rust situation</b>	Phoenix +	1.5 l/ha
T1	G.S. 29 - 31	<b>For heavy rust situation</b>	Talius/Justice	0.15 l/ha
T1	G.S. 29 - 31	<b>For eyespot situation</b>	Entargo +	0.5 l/ha
T1	G.S. 29 - 31	<b>For eyespot situation</b>	Revystar XE +	1.0 to 1.25 l/ha
T1	G.S. 29 - 31	<b>For eyespot situation</b>	Phoenix +	1.5 l/ha
T1	G.S. 29 - 31	<b>For eyespot situation</b>	Talius/Justice	0.15 l/ha

### T1.5

Treatment Timing	Growth Stage (G.S.) Target timing or disease.	Disease	Product/ a.i.	Rate
T1.5	Optional if difficulty keeping to 3 week timings	<b>Note: 14 day interval between T1.5 Tebuconazole application and T2 application.</b>	Tebuconazole	0.75 l/ha
T1.5	Optional if difficulty keeping to 3 week timings	<b>Or in a septoria situation</b>	Prothioconazole	0.6 l/ha

### T2

Treatment Timing	Growth Stage (G.S.) Target timing	Disease	Product/ a.i.	Rate
T2	G.S 37 and no later then 3 weeks after T1 application		Revystar XE +	1.0-1.25 l/ha

T2	G.S 37 and no later than 3 weeks after T1 application		Phoenix	1.5 l/ha
T2	G.S 37 and no later than 3 weeks after T1 application	<b><i>Optional if high yellow rust pressure, strongly recommend for in the East and Southern regions.</i></b>	<i>Tebuconazole</i>	<i>0.75-1.0 l/ha</i>

# Spring wheat - spring sown.

## Pre T1

For disease infections before G.S. 29 consult the relevant trials co-ordinator.

## T1

Treatment Timing	Growth Stage (G.S.) - target timing	Product / active ingredient	Rate
T1	G.S. 29 – 31	Revystar XE +	1.0 – 1.25 l/ha
T1	G.S. 29 – 31	Comet 200 +	0.4 – 0.6 l/ha
T1	G.S. 29 – 31	Arizona +	1.0 l/ha
T1	G.S. 29 – 31	Talius/Justice	0.15 l/ha

## T2

Treatment Timing	Growth Stage (G.S.) - target timing	Disease	Product / active ingredient	Rate
T2	G.S. 37 and no later than 3 weeks after T1 application		Revystar XE +	1.0 – 1.25 l/ha
T2	G.S. 37 and no later than 3 weeks after T1 application		1.0 l/ha Arizona	Arizona
T2	G.S. 37 and no later than 3 weeks after T1 application	<i>Optional if mildew established</i>	<i>0.25 – 0.5 l/ha</i>	<i>Cyflamid</i>

T3

Treatment Timing	Growth Stage (G.S.) - target timing	Disease	Product / active ingredient	Rate
T3	G.S. 51 – 61		Prosaro +	0.8 l/ha
T3	G.S. 51 – 61		Comet 200 +	0.4 – 0.6 l/ha
T3	G.S. 51 – 61	<i>If including Arizona, must not exceed G.S. 59</i>	<i>Arizona</i>	<i>1.0 l/ha</i>

## Winter barley

Before T0

*Optional - If net blotch or mildew present in Autumn or early Spring please contact the trials co-ordinator*

T0

Treatment Timing	Growth Stage (G.S.) - target timing	Product / active ingredient	Rate
T0	G.S. 26 – 30 at start of Spring growth	Proline 275 +	0.3 – 0.5 l/ha
T0	G.S. 26 – 30 at start of Spring growth	Comet 200	0.35 – 0.5 l/ha

T1

Treatment Timing	Growth Stage (G.S.) - target timing	Disease	Product / active ingredient	Rate
T1	G.S. 30 – 31 No later than 4 weeks after T0 application	<b>Note: Maximum application of Siltra Xpro is 1.0 l/ha.</b>	Siltra Xpro +	0.5 – 0.75 l/ha
T1	G.S. 30 – 31 No later than 4 weeks after T0 application		Arizona +	1.5 l/ha
T1	G.S. 30 – 31 No later than 4 weeks after T0 application		Cyflamid	0.25 – 0.35 l/ha

T2

Treatment Timing	Growth Stage (G.S.) - target timing	Disease	Product / active ingredient	Rate
T2	<i>G.S 39 – 45 (earliest varieties should not exceed G.S. 45)</i>		Revystar XE +	1.0 – 1.25 l/ha

Treatment Timing	Growth Stage (G.S.) - target timing	Disease	Product / active ingredient	Rate
T2	<i>G.S 39 – 45 (earliest varieties should not exceed G.S. 45)</i>		Arizona	1.5 l/ha
T2	<i>G.S 39 – 45 (earliest varieties should not exceed G.S. 45)</i>	<p data-bbox="772 349 1134 461"><i>Optional: If net blotch or rhynchosporium is developing.</i></p> <p data-bbox="772 495 1134 573"><b><u>Not to be applied after the start of flowering.</u></b></p>	Proline 275	<i>0.3 – 0.5 l/ha</i>

T3

Treatment Timing	Growth Stage (G.S.) - target timing	Disease	Product / active ingredient	Rate
T3	G.S. 59 – 61	Optional ( <b>TO BE CONSIDERED COMPULSORY IF BROWN RUST IS A RISK</b> ). <b>Must not be applied after the start of flowering</b>  NOTE: Comet 200 must be applied before G.S. 59	Fandango Or Proline 275 + Comet 200	0.75 l/ha  0.3 – 0.5 l/ha 0.35 – 0.5 l/ha

## Spring barley

T0

Treatment Timing	Growth Stage (G.S.) - target timing	Disease	Product / active ingredient	Rate
T0	G.S. 13 – 15	Optional: If disease is present	Proline 275	0.2 – 0.4 l/ha

T1

Treatment Timing	Growth Stage (G.S.) - target timing	Disease	Product / active ingredient	Rate
T1	G.S. 25 – 31 Applications at the early end of this range may be necessary if rhynchosporium or mildew are developing.		Siltra Xpro +	0.4 – 0.6 l/ha
T1	G.S. 25 – 31 Applications at the early end of this range may be necessary if rhynchosporium or mildew are developing.		Arizona	1.0 l/ha
T1	G.S. 25 – 31 Applications at the early end of this range may be necessary if rhynchosporium or mildew are developing.	Optional: if mildew is present	Cyflamid	0.25 – 0.35 l/ha

T2

Treatment Timing	Growth Stage (G.S.) - target timing	Disease	Product / active ingredient	Rate
T2	Note: If trial is grown for malting quality Revystar XE <b>must not</b> be applied after G.S. 45		Revystar XE +	0.75 –1.0 l/ha
T2	Note: If trial is grown for malting quality Revystar XE <b>must not</b> be applied after G.S. 45		Arizona	1.5 l/ha

### T3

Treatment Timing	Growth Stage (G.S.) - target timing	Disease	Product / active ingredient	Rate
T3	G.S. 59 – 69	<i>Optional: If net blotch or rhynchosporium or fusarium developing</i>	<i>Proline 275</i>	<i>0.3 – 0.5 l/ha</i>

## Winter oats

T0

Treatment Timing	Growth Stage (G.S.) - target timing	Disease	Product / active ingredient	Rate
T0	G.S. Mid to late tillering		Cyflamid +	0.25 – 0.35 l/ha
T0	G.S. Mid to late tillering		Prothioconazole	0.35 l/ha

T1

Treatment Timing	Growth Stage (G.S.) - target timing	Disease	Product / active ingredient	Rate
T1	G.S. 31	<b>Note: Maximum applications Siltra Xpro is 1.0 l/ha.</b>	Siltra Xpro +	0.4 – 0.6 l/ha
T1	G.S. 31		Talius/Justice	0.15 l/ha
T1	G.S. 31	<i>Optional - if crown rust is a problem.</i>  <b>Note: Only <u>TWO</u> applications of Comet 200 permitted per crop. Apply at <u>T1 OR T2</u> which ever more appropriate to season and conditions.</b>	Comet 200	0.5 l/ha



## T2

Treatment Timing	Growth Stage (G.S.) - target timing	Disease	Product / active ingredient	Rate
T2	G.S. 39 – 45	<b>Note: Maximum application of Siltra Xpro is 1.0 l/ha.</b>	Siltra Xpro +	0.4 – 0.6 l/ha
T2	G.S. 39 – 45		Cyflamid	0.25 – 0.35 l/ha
T2	G.S. 39 – 45	<i>Optional - If crown rust is a problem, SEE NOTE ABOVE</i>	Comet 200	0.5 l/ha

## T3

Treatment Timing	Growth Stage (G.S.) - target timing	Disease	Product / active ingredient	Rate
T3	G.S. 45 – 59	<i>Optional: If crown rust pressure has remained high before G.S.59 – 61. SEE NOTE ABOVE, NOT IF NOT APPLIED AT T1 &amp; T2, MAX 2 APPLICATIONS PER CROP</i>	Comet 200+	0.5 l/ha
T3	G.S. 45 – 59		Tebuconazole/ Toledo	0.5 l/ha

# Spring oats

T0

Treatment Timing	Growth Stage (G.S.) - target timing	Disease	Product / active ingredient	Rate
T0	G.S. 13 – 15	<i>Optional: If mildew present.</i>	Cyflamid +	0.25 – 0.35 l/ha
T0	G.S. 13 – 15		Prothioconazole	0.35 l/ha

T1

Treatment Timing	Growth Stage (G.S.) - target timing	Disease	Product / active ingredient	Rate
T1	G.S. Mid to late tillering	<b>Note: Maximum applications Siltra Xpro is 1.0 l/ha.</b>	Siltra Xpro +	0.4 – 0.6 l/ha
T1	G.S. Mid to late tillering		Talius/Justice	0.2 l/ha
T1	G.S. Mid to late tillering	<i>Optional: If crown rust is a problem.</i>	Comet 200	0.5 l/ha

T2

Treatment Timing	Growth Stage (G.S.) - target timing	Disease	Product / active ingredient	Rate
T2	G.S. 39 – 45		Siltra Xpro +	0.4 – 0.6 l/ha
T2	G.S. 39 – 45		Cyflamid	0.25 – 0.35 l/ha
T2	G.S. 39 – 45	<i>Optional: If crown rust pressure is a problem.</i>	Comet 200+	0.5 l/ha
T2	G.S. 39 – 45		Tebuconazole	0.5 l/ha

## Winter rye & triticale

T0

Treatment Timing	Growth Stage (G.S.) - target timing	Disease	Product / active ingredient	Rate
T0	G.S. 30		Tebuconazole +	0.75 – 1.0 l/ha
T0	G.S. 30	<i>Optional: If mildew present, TRIALS OPERATORS' DISCRETION WETHER TO USE EITHER AT T0 OR T1.</i>	Cyflamid	0.25 – 0.35 l/ha

T1

Treatment Timing	Growth Stage (G.S.) - target timing	Disease	Product / active ingredient	Rate
T1	G.S. 31 – 32	Increase rate for high rust.	Elatus Era +	1.0 l/ha
T1	G.S. 31 – 32	<i>Optional: If mildew present, TRIALS OPERATORS' DISCRETION WETHER TO USE EITHER AT T0 OR T1.</i>	Cyflamid	0.25 – 0.35 l/ha

T2

Treatment Timing	Growth Stage (G.S.) - target timing	Disease	Product / active ingredient	Rate
T2	G.S. 39 – 45		Revystar XE	0.5 – 1.0 l/ha

T3

Treatment Timing	Growth Stage (G.S.) - target timing	Disease	Product / active ingredient	Rate
T3	G.S. 59 – 61	<i>Optional: Rye only if rust remain a problem before G.S.61.</i>	Prosaro	0.8 l/ha

## Spring triticale

Growth Stage (G.S.) - target timing or disease	Product / active ingredient	Rate
G.S.31 – 32	Elatus Era +	1.0 l/ha
G.S.31 – 32	Talius/Justice	0.15 l/ha
G.S. 32 – 45	Revystar XE	0.5 – 0.75 l/ha

# Recommended List Fungicide and PGR Ag Chem product labels

## Introduction

This list can be used to help find the relevant product labels for PGRs, fungicides, herbicides, and insecticides listed in the main protocols. The links below can be used to navigate to the company page and search for the product labels.

### Adama UK

[Listen > Learn > Deliver | ADAMA](#)

### BASF

[Product Labels, MSDSs & EISs \(basf.co.uk\)](#)

### Bayer Crop Science

[Crop Protection Products from Bayer Crop Science UK](#)

### Belchim UK

[Products UK – Belchim Crop Protection](#)

### Certis Europe

[Products A-Z and Key Documents | Certis Europe United Kingdom](#)

### Corteva/DU Pont

[Find a Product | Corteva Agriscience](#)

### Syngenta

[Labels and SDS downloads | Syngenta](#)

# Appendix 8 – Moisture content determination for yield

Yield data must be corrected to 15% moisture content. In order to do this, the moisture content of the harvested plot grain is required. One of three methods of determining dry matter must be used – the oven method, electronic moisture analysers method or NIR determination.

## 1 Oven method

Samples are dried until constant mass is achieved. For expediency it is permissible to dry samples for a fixed time provided it can be demonstrated that this is sufficient to reliably achieve constant mass for samples even when the chosen apparatus is fully loaded with samples.

Apparatus and Equipment.

Oven. Electrically heated and controlled in such a way that, during normal working, the mean temperature of the air and of the shelves carrying the test samples is 100° C and operates within the range 96 - 104° C. (Temperature to be reviewed by the Procedures Development Group).

The oven should be regularly maintained and regularly checked for correct operation.

Sample drying trays. Durable under test conditions and being of a size which enables the test sample to be distributed evenly within the tray and at depth which does not protract the drying time.

Balance. Accuracy 0.1 g ± 0.05 g. The balance should be regularly serviced and calibrated. Frequent checks on its correct operation should be made during the period when the balance is in use.

Method

The test samples are received direct from the combine in hermetically sealed bags or containers. Weigh a fully representative 100 g sub-sample or an accurately recorded catch-weight between 100-200 g and place into the drying tray with an identifying label.

Place the drying trays containing the test samples into the pre-heated oven. Dry the test samples for the pre-determined period or until constant mass is achieved (see below).

Remove the test samples from the oven and allow to cool to ambient temperature.

Record the dry weight of the test sample to 0.1 g.

If achievement of constant mass is to be directly measured, five check samples should be removed from a range of positions within the oven after a period of about 16hrs. The dry weight of these samples should be recorded as above. The check samples should be returned to the oven and dried for a further 2 hours and the dry weight again recorded. A dry matter content of less than 0.3% between the two determinations will be accepted as representing constant mass. If constant mass has not been achieved, the check samples should be returned to the oven for further periods of two hours until constant mass is observed.

## Results

The dry matter content of the test sample is calculated as follows;

$$\text{Dry matter (\%)} = \frac{\text{Dry test sample weight}}{\text{Original test sample weight}} \times 100$$

When all samples from a given trial have been recorded, the fresh and dry weights are immediately reported to the Data Handling Operator electronically. When the dry weights are reported as a percentage, the fresh weight should be reported as 100.

## 2 Electronic moisture assessment (moisture analysers)

### Principles

Moisture analysers, either separate instruments or probes on combines, may be used for determining the dry matter of harvested grain. There are no restrictions on the make or model of moisture analyser that may be used, provided the conditions described below are met.

The manufacturer's recommendations for use must be followed. On-combine analysis must only be carried out on equipment specifically manufactured for this purpose. 'Desk-top' analysers should not be used on the combine because it has been shown that heat and vibration can cause inaccuracy.

### Equipment

The analysing equipment must:

- be calibrated at least once annually for each crop according to the manufacturer's instructions using check samples (see reference below) and have a moisture content accuracy of plus/minus 0.5%. The calibration data should be retained for a minimum of 1 year.
- be serviced regularly, especially just prior to harvest, according to manufacturer recommendations. The action taken should be documented and the information held for a minimum of 1 year.
- be fit for use in accordance with manufacturer instructions. It should have an adequate power supply throughout operation. Instructions should be held with the machine and all operators adequately trained in its operation.

### In the field:

- the determination of dry matter must be the same for all plots in a trial replicate. For this reason, there should be minimal risk of rainfall during the harvest of a replicate. If there is a significant risk then backup samples should be taken from all plots to allow comparison through the oven method.
- the grain samples to be analysed must be between 83 and 88% dry matter (12 to 17% moisture content). If it is possible that samples in a replicate may fall outside this range, samples must be taken

from all plots so that the oven method may be used should it be necessary. Polythene bags and plot identity labels must be carried at all times to allow this to be carried out.

- The grain to be analysed must be fully ripe with no green ears/grains in any sample. In these cases the samples for the oven method should be used.
- The data sent to the Data Handling Operator must be in the form DRY MATTER%.

References:

BS 4317-24:1990, ISO 7700/1-1984 Methods of test for cereals and pulses. Method of checking the calibration of moisture meters for cereals.

### 3 NIR determination

The NIR method is permitted for the measurement of moisture content 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.



# Appendix 9 – Dates by which records should be submitted

## 1 To Trials Organiser

Record	Latest date of receipt by Trials Organiser
Site data part 1 (including site sketch)	Within 2 months of drilling trial (autumn sown trials) Within 1 month of drilling trial (spring sown trials)
Site data part 2	By the time trials harvested
Plot records (in approved electronic format)	Growing Trial Operator should notify Trials Organiser that trial has been harvested within 2 days of harvest

## 2 Plot records to Data Handling Operator

Record	Date
Plot records SHOULD be sent to Data Handling Operator	Yield and moisture data within 3 days of harvest Other data within 10 days of record being taken

## 3 Plot samples to Quality Testing Operator

Samples	Date
Plot samples for quality testing SHOULD be sent to Quality Testing Operator	Within 2 days of harvest

# Appendix 10 – Growth stages of cereals

## SEEDLING GROWTH

- 10 first leaf through coleoptile
- 11 first leaf unfolded
- 12 2 leaves unfolded
- 13 3 leaves unfolded
- 14 4 leaves unfolded
- 15 5 leaves unfolded
- 16 6 leaves unfolded
- 17 6 leaves unfolded
- 18 8 leaves unfolded
- 19 9 or more leaves unfolded

## TILLERING

- 20 main shoot only
- 21 main shoot and 1 tiller
- 22 main shoot and 2 tillers
- 23 main shoot and 3 tillers
- 24 main shoot and 4 tillers
- 25 main shoot and 5 tillers
- 26 main shoot and 6 tillers
- 27 main shoot and 7 tillers
- 28 main shoot and 8 tillers
- 29 main shoot and 9 or more tillers

## STEM ELONGATION

- 30 Ear at 1 cm
- 31 1st node detectable
- 32 2nd node detectable
- 33 3rd node detectable
- 34 4th node detectable
- 35 5th node detectable
- 36 6th node detectable
- 37 flag leaf just visible
- 39 flag leaf ligule/collar just visible

## BOOTING

- 41 flag leaf sheath extending
- 43 boots just visibly swollen
- 45 boots swollen
- 47 flag leaf sheath opening
- 49 first awns visible

#### INFLORESCENCE (EAR EMERGENCE)

- 51 First spikelet of inflorescence just visible
- 52  $\frac{1}{4}$  of inflorescence emerged
- 55  $\frac{1}{2}$  of inflorescence emerged
- 57  $\frac{3}{4}$  of inflorescence emerged
- 59 inflorescence completed

#### ANTHESIS

- 60 beginning of anthesis
- 61
- 64 anthesis half-way
- 65
- 68 anthesis completed
- 69

#### MILK DEVELOPMENT

- 71 caryopsis watery ripe
- 73 early milk
- 75 medium milk
- 77 late milk

#### DOUGH DEVELOPMENT

- 83 early dough
- 85 soft dough
- 87 hard dough

#### RIPENING

- 91 caryopsis hard (difficult to divide by thumb-nail)
- 92 caryopsis hard (can no longer be dented by thumb-nail)
- 93 caryopsis loosening in daytime

Reference: Tottman D R, Broad H (1987) Decimal Code for the Growth Stages of Cereals *Annals of Applied Biology* 100, 683-687.

## Appendix 11 – Assessment keys for cereal diseases

- 1) Examine top 4 leaves. If top leaf has been fully expanded for less than 14 days, refer to 2nd leaf as 'top leaf'.
  - 2) Ignore all naturally senescent leaf tissue.
  - 3) Include all chlorosis and necrosis attributable to disease.
  - 4) Record % infection; use interpolated values (e.g. 3%) if necessary.
- If foci present, record average over the plot as a whole.

% Infection	Crown rust	Yellow rust	Brown rust
0	No infection observed	No infection observed	No infection observed
0.1	1 small cluster of pustules per tiller	1 stripes per tiller	25 pustules per tiller
1	1 cluster per leaf	2 stripes per leaf	100 pustules per leaf
5	Most tillers infected but some top leaves uninfected	Most tillers infected but some top leaves uninfected	Top leaf – numerous pustules but leaves appear green overall
10	All leaves infected but leaves appear green overall	All leaves infected but leaves appear green overall	Top leaf – pustules sufficiently dense to give brown appearance in patches
25	Leaves appear ½ infected ½ green	Leaves appear ½ infected ½ green	Leaves appear ½ infected ½ green
50	Leaves appear more infected than green	Leaves appear more infected than green	Leaves appear more infected than green
75	Very little green leaf tissue left	Very little green leaf tissue left	Very little green leaf tissue left
100	Leaves dead - no green tissue left	Leaves dead - no green tissue left	Leaves dead - no green tissue left

% Infection	Septoria	Rhynchosporium	Net blotch
0	No infection observed	No infection observed	No infection observed
0.1	1 lesion per 10 tiller	1 lesion per 10 tillers	1 small lesion per 10 tillers
1	2 small lesions per tiller	1 lesion per tiller	1 small lesion per tiller
5	Small lesions beginning to form areas of dead tissue across width of leaf	Discrete lesions on most tillers, about 2 per leaf	2 lower leaves appear ¼ infected. Other leaves - few lesions
10	2 lower leaves – large areas of diseased tissue some covering 1/3 of leaf	Lesions coalescing but leaves appear green overall	2 lower leaves appear ½ infected. Other leaves - numerous lesions
25	Leaves appear ½ infected ½ green	Leaves appear ½ infected ½ green	Leaves appear ½ infected ½ green
50	Leaves appear more infected than green	Leaves appear more infected than green	Leaves appear more infected than green
75	Very little green leaf tissue left	Very little green leaf tissue left	Very little green leaf tissue left
100	Leaves dead - no green tissue left	Leaves dead - no green tissue left	Leaves dead - no green tissue left

<b>% Infection</b>	<b>Mildew</b>
0	
0.1	3 pustules per tiller
1	5 pustules per leaf
5	2 lower leaves appear $\frac{1}{4}$ infected
10	2 lower leaves appear $\frac{1}{2}$ infected
25	Leaves appear $\frac{1}{2}$ infected $\frac{1}{2}$ green
50	Leaves appear more infected than green
75	Very little green leaf tissue left
100	Leaves dead - no green tissue left

% Infection	Ramularia
0	
1 – 5	Sparse lesions on upper leaves
6 – 10	More lesions on upper leaves
11 – 20	Numerous lesions on middle and upper leaves with some necrosis
21 – 30	Many lesions and severe necrosis on upper leaves and lesions on middle leaves
31 – 40	Extensive lesions on upper leaves many lesions on middle leaves and necrosis
41 – 50	Severe damage to upper leaves more lesions and necrosis on middle and lower leaves
51 – 75	100% lesions on upper leaves severe necrosis on middle leaves
75 – 100	Almost all leaves necrotic with lesions on all leaves

# Ear Blight of wheat (*Fusarium Spp.*)

Percentage area infected  
(0 = Healthy)

Notes on assessment

- 1) Carry out the assessment between GS 80-90.
- 2) Conduct a 'whole-plot' assessment using the diagram above as a guide to infection levels.
- 3) Estimate the infection level at several points in the plot, giving a single score per plot that is representative of the whole plot.

For details  
Parry D  
Bayles



2



5



10



25



50



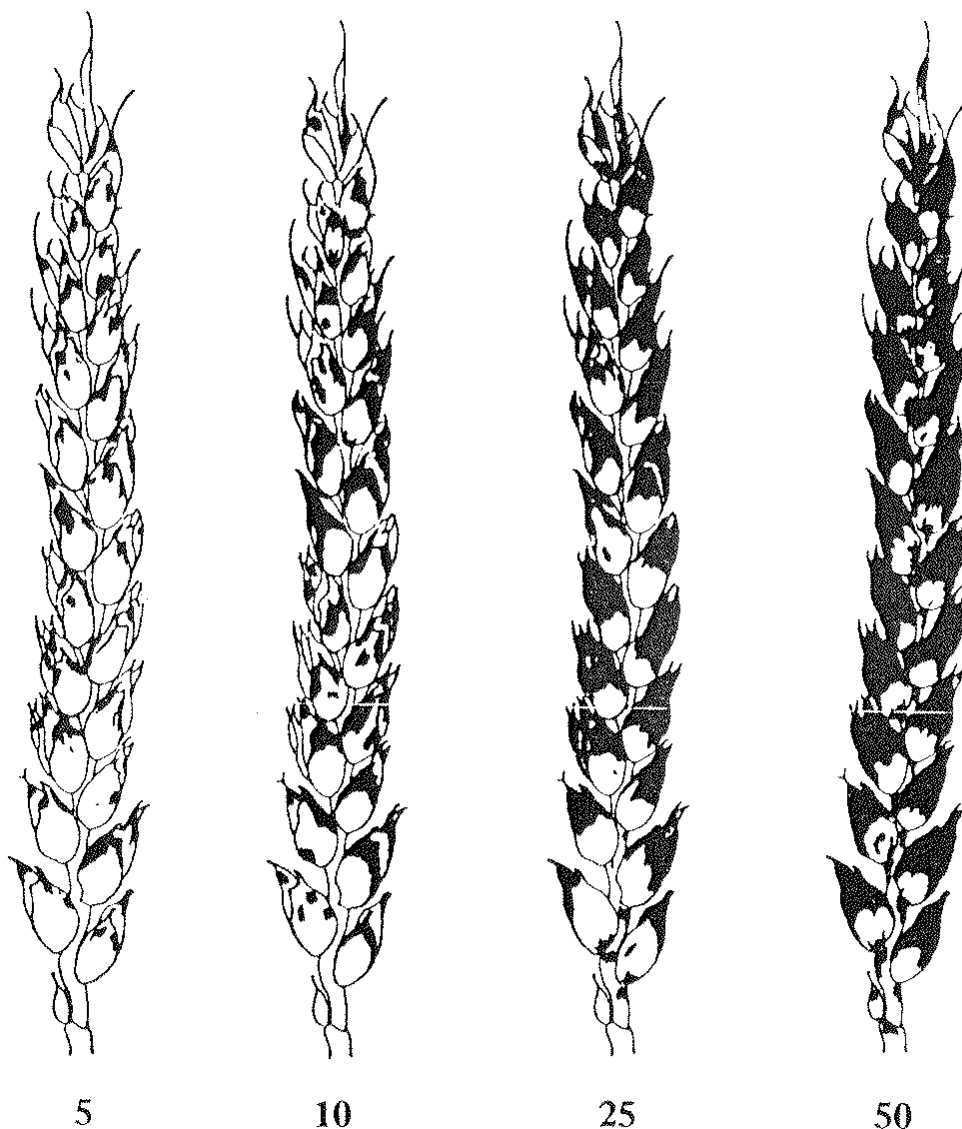
90

further  
see  
W,  
R A &

Priestley R H (1984).  
Resistance of winter wheat varieties to Ear Blight (*Fusarium culmorum*).  
Journal the National Institute of Agricultural Botany 16, 465-468.



## Wheat glume blotch (*Septoria nodorum* Berk.)



Percentage of ear affected

Notes on assessment

- 1) Carry out the assessment between GS 80-90.
- 2) Conduct a 'whole-plot' assessment using the diagram above as a guide to infection levels.
- 3) Estimate the infection level at several points in the plot, giving a single score per plot that is representative of the whole plot.

For further details see Parry D W, Bayles R A & Priestley R H (1984).  
Resistance of winter wheat varieties to Ear Blight (*Fusarium culmorum*).  
Journal the National Institute of Agricultural Botany 16, 465-4

For further information and photos see the HGCA cereals encyclopaedia at <http://cereals.ahdb.org.uk/>.



© Crown copyright 2023

You may re-use this information (excluding logos) free of charge in any format or medium, under the terms of the Open Government Licence v.3. To view this licence visit [www.nationalarchives.gov.uk/doc/open-government-licence/version/3/](http://www.nationalarchives.gov.uk/doc/open-government-licence/version/3/) or email [PSI@nationalarchives.gsi.gov.uk](mailto:PSI@nationalarchives.gsi.gov.uk)

This publication is available at [www.gov.uk/government/publications](http://www.gov.uk/government/publications)

Any enquiries regarding this publication should be sent to us at

[webmaster@apha.gov.uk](mailto:webmaster@apha.gov.uk)

[www.gov.uk/apha](http://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.