Animal & Plant Health Agency

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

Mustard

September 2024

Contents

Changes

- C.3.1.1 There will be a minimum of three replicates sown. Replicates are dependent on the number of varieties to be tested.

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 Mustard

A.2.Scope

A.2.1 These procedures apply to all varieties of Mustard.

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 Trials Organisers and Operators

A.3.2.1 Trial Organisers

a. England and Wales
British Society of Plant Breeders Ltd (BSPB)
BSPB House
114 Lancaster Way Business Park
Ely
Cambs. Jeremy M: 07747 567351
CB6 3NX Louise M: 07917 046705
Email: jeremy.widdowson@bspb.co.uk
louise.everest@bspb.co.uk

b. Scotland
SASA
Roddinglaw Road
Edinburgh Tel No: 0131 2448899
EH12 9FJ
Email: russell.thomson@sasa.gov.scot

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

A.3.2.3 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.3.2.4 Growing Trial Operators, Seed Handling Operators and Quality Testing Operators.

The Trials Organiser is responsible for proposing potential Growing Trial Operators and Quality Testing Operators to carry out trials and tests as determined by the Procedures Development Group 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 Trial Operator in accordance with the VCU Protocol and these Procedures.

A.3.2.5 A list of all approved Organisers and Operators is shown in Appendix 1.

A.3.3 **VCU Protocol and Procedures non-compliance**

A.3.3.1 Where these procedures use the word “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 a 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 Handling of trial seed

A.3.5.1 The Trials Organiser is responsible for organising the handling 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 fit for the purpose. Seed treatment products are listed in Appendix 2.

A.3.6 Dispatch of seed

A.3.6.1 The Trials Organiser will arrange for seed to be dispatched by the agreed deadlines to the Growing Trial Operators, and, for authentication, to the DUS testing centres including, where appropriate, foreign testing authorities.

A.3.7 Monitoring of VCU 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 must 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.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 Special tests

An additional test for characters not specified in the procedures may be requested by the applicant. APHA is responsible for liaison with the Trials Organisers to produce a procedure for the conduct of a special test or trial. This procedure would require the approval of the National Authorities.

A.4.5 Summary of VCU trial assessments required.

Bold = Obligatory *Italics = Additional. Assessed only if requested by the applicant.*

Type of character	Reference	Description of assessment
Yield	Section C	**Plot yield** **Moisture content**
Behaviour with respect to factors in the physical environment.	Section C	**Maturity** **Winter hardiness** **Standing ability** *Plant height* *Earliness of flowering*
Resistance to harmful organisms	Section D	None routinely recorded
Quality characteristics	Section E	None routinely recorded

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

Sowing date
Harvest date
Plot size
Bird damage (where present at a level which will affect results
Seed loss (where present at a level which will affect results)
Combine harvester losses (where present at level which will affect results)

Section B – Seed handling procedures

B.1 Seed handling procedures

B.1.1 See GENERAL INFORMATION, SECTION 5 - Minor Crop VCU Procedures Introduction.

B.2 Authentication of VCU seed

B.2.1 APHA will notify the Seed Handling Operator of the DUS Test Centre to which a 50 g sample of each variety of mustard should be sent for authentication.

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 mustard crop to be grown, with a suitable break from cruciferous crops, to minimise the chance of club root incidence within the trial.

C.2.3 Soil type should be typical of those on which mustard would be grown locally. Soil fertility and texture should be uniform across the site. The soil should be sufficiently uniform with no substantial variations in previous cropping, ridges, furrows, etc.

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 grazing damage from wild fauna.

C.2.5 The trial area should be cultivated in the direction of ploughing 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 The harvested plot area per variety should be not less than 20 m² per replicate and four replicates must be used. Plots should be drilled to a greater length than required and cut back to the required length prior to harvest. The plot width for calculating harvested area is measured centre gap to centre gap with an inter-plot gap in the range 0.5 m to 0.8 m. There will be a minimum of three replicates sown. Replicates are dependent on the number of varieties to be tested.

C.3.2 **Plant population**

C.3.2.1 The seed rate is 150 seeds/m². Seed may be supplied to trial sites either chemically treated in plot modules, or in bulks for packeting on site.

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 Trial Design and Data Handling Operator.

C.3.3.2 The trial should be sown according to the plan produced by the Trial Design and Data Handling Operator.

C.3.3.3 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.

C.3.4 **Drilling**

C.3.4.1 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.3.4.2 At least one discard plot must be drilled on either side of the trial with the same drill and while the trial is drilled.

C.3.4.3 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 one month of sowing the Growing Trial Operator must confirm that the trial has been sown to plan or give full details of any changes to plan. This should be done by clearly highlighting the changes in the electronic plan and returning it to the Trial Design and 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.
- 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, 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 should be consulted.

C.4.4 **Growth regulators**

Should not be used on mustard trials.

C.4.5 **Pest and disease control**

C.4.5.1 **Pest control**
Seed dressings will include an insecticide element. Where there is a risk of significant flea beetle attack Growing Trial Operators must ensure that adequate pre- and post-emergence control measures are taken. Assessments should be made wherever pest damage occurs since decisions have to be made on the validity of each plot affected. Grazing, particularly by pigeons, may be selective and control measures should be taken if necessary.

C.4.5.2 **Disease control**

Growing Trial Operators should be aware that severe outbreaks of Sclerotinia and Alternaria could threaten the validity of the trial and should weather patterns favour the build-up of these diseases, then an appropriate fungicide should be applied at mid-flower for Sclerotinia or from mid-flower to pod senescence for Alternaria. Although the risks of Sclerotinia and Alternaria development are low in mustard damaging attacks could occur. Sclerotinia may develop if a flush of apothecia coincides with flowering and periods of wet weather; Alternaria may develop rapidly if warm and wet conditions occur during late flowering and pod development. If control measures were ineffective for any reason, and these diseases did develop, levels should be recorded. Other disease control should only be undertaken after agreement by the Trials Organiser.

C.4.6 **Irrigation**

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

C.4.7 **Pathways**

Internal pathways should be made after the risk of pigeon damage has passed.

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. 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:**

Trials can be swathed or desiccated and direct combined (using a translocated desiccant such as glyphosate).

C.5.3 **Samples**

C.5.3.1 Samples are required from all plots for moisture determination using the oven method. If additional samples are required, they will be notified to the Growing Trial Operator by the Trials Organiser. All samples should be labelled with the labels provided, giving variety name/breeders reference, AFP number, replicate number, and Growing Trial Operator identification number.

C.5.3.2 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.5.3.3 Two samples must be taken from each plot at harvest. A 200 g sample must always be taken at the time of plot weighing and sealed in a polythene bag for dry matter and oil content determination. In addition, a 100 g sample is taken and sealed in a cloth bag for glucosinolate analysis. One label should be placed inside the bag, and this sealed by rolling over the top and securing the bag and the second label with rubber bands. At sites where higher moisture levels are frequently experienced and dry matters are determined immediately in the trial operator's laboratory a single sample of 500g per plot and subsequently divided may be taken for dry matter, oil and glucosinolate content.

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

C.5.4.1 Appendix 6 lists the records, with deadlines, to be sent to the Trials Organiser. Diary sheets and any other field records should be returned to the Trials Organiser within 5 working days of harvest.

C.5.4.2 All plot records should be transmitted to the Trial Design and Data Handling Operator following the deadlines set out in Appendix 6. 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.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:
   a) a map of site location showing nearby settlements and roads
   b) a sketch showing the layout of trials in the field with access points and
   c) 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 for all trials visits 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 Trial Design and Data Handling Operator in an approved format using the AFP number, variety name and units as listed in Sections C and D.

C.6.2.2 All observations should be checked at the time of recording to identify any unusual plot performance. These observations should be noted by the recorder and any probable causes identified, together with a recommendation for whether the data should remain in the analysis or should be excluded.

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 it has been excluded.

C.6.2.5 Where a plot record is missing the Growing Trial Operator should record this in any data file or hard copy medium as a symbol thereby indicating there is no recorded value associated with this plot.

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 Trial Design and Data Handling Operator as soon as possible after they are completed.

C.6.2.7 All records must be returned as soon as reasonably possible and when complete for the whole trial. Indicative deadlines are given in Appendix 6. All records must be returned by the final deadlines.

C.6.3 **Procedures for recording characters**

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

C.6.3.1 **PLOT YIELD AND MOISTURE CONTENT (OBLIGATORY) (kg)**

The following information must accompany the yield data:

The moisture content % of the harvested grain, determined by oven method.

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 adjustment for the inter-plot gap should be no greater than 0.8 m.
If these are not the same for every plot a separate record must be submitted.

Growth stage: usually 9.9 at harvest. The Growth Stage Chart for mustard is at Appendix 7.

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

C.6.3.2 **MATURITY from all plots (OBLIGATORY) (1-9)**

Maturity should be judged by making a visual estimate of canopy senescence, where.
1 all pods green
9 all pods bleached and brittle

Unrepresentative areas of the plot should be avoided when making assessments, for example, localised diseased infections.

C.6.3.3 **STANDING ABILITY from all plots (OBLIGATORY) (1-9)**

1 completely lodged
9 no lodging

The aim of this score is to describe the canopy structure at harvest. A score of 5 can describe half the plot completely flat or the whole plot leaning at 45 degrees.

C.6.3.4 *PLANT HEIGHT from all plots (ADDITIONAL) (cm)*

Record average plot height at the end of flowering before leaning or lodging takes place. If lodging has occurred, choose a representative area of the plot, lift a number of plants against the measuring pole and record an average height.

C.6.3.5 *EARLINESS OF FLOWERING from all plots (ADDITIONAL) (1-9)*

1 very early
9 very late

Record when the earliest variety is in full flower and score all varieties relative to this. An assessment on one occasion is normally sufficient. Estimate the date of full flowering for the earliest control variety.

C.6.3.6 **SOWING DATE of each trial (OBLIGATORY) (Day/month/year)**

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

C.6.3.7 **HARVEST DATE (OBLIGATORY) (Day/month/year)**

This is recorded in Part 2 of the Site Information Form.

C.6.3.8 **BIRD DAMAGE from all plots (OBLIGATORY IF PRESENT) (1-9)**

1 all plants severely damaged
9 no plants damaged

This must be recorded where present at a level which will affect results

Indicate the cause of damage and, in the Diary section, what action has been taken to minimise further damage.

C.6.3.9 **RESISTANCE TO SEED LOSS from all plots(OBLIGATORY IF PRESENT)(1-9)**

1 severe seed loss
9 no seed loss

This must be recorded where present at a level which will affect results.

Base scores either on observation of pod shattering or counts of seed on the ground if shedding is thought to be serious. Seed loss is easier to assess before combining. Ensure that combines are set correctly to minimise losses at harvest. Estimate the number of seeds lost per m² for the plot(s) with the most losses so that the approximate yield loss can be estimated.

C.6.3.10 **COMBINE LOSSES from all plots (OBLIGATORY IF PRESENT) (1-9)**

This must be recorded where there is evidence of combine losses at a level which will affect results.

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

C.6.3.11 **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.6.3.12 **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 to:

1. Give inspectors reasonable access to trials and provide full location and site details (if not already supplied with site data 1).
2. Provide the inspector with information (for example pesticide sprays applied etc) within seven days of a request.
3. Co-operate with the inspector in making any non-routine assessments required to establish the validity of the trial (for example population counts).
4. 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 The Growing Trial Operator is responsible for carrying out these procedures

D.1.2 **Disease observation plots**

No disease observation plots are grown routinely.

D.1.3 **Naturally occurring disease in VCU growing trials**

D.1.3.1 Light leaf spot and stem canker should be recorded when the level of infection on the most affected variety is over 5% or a score of 4 of the leaf area of infected plants.

D.1.3.2 Other naturally occurring disease is not normally recorded in the growing trials. However, if disease levels increase to more than 5%/score 4 of the leaf area (or 5% /score 4 of infected plants as appropriate for the diseases) on the most affected variety a score should be made on the whole trial and sent to the Trial Design and Data Handling Operator. Confirmation of the identity of a disease should be obtained from an appropriate plant pathologist if required.

D.1.3.3 **Recording methods**

D.1.3.4 Appropriate assessment keys are given in Appendix 8. All disease records to be sent to the Trial Design and Data Handling Operator as soon as they are made.

Disease data should be received by 31st August

D.2 Inoculated disease tests

No inoculated disease tests are carried out routinely.

Section E – Quality testing procedures

E.1 Responsibilities

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

E.2 Quality assessment methodology

E.2.1 **Moisture content determination**

The following procedure must be followed.

A 105 g sample of seed *(*± 5g) is placed in the drier which must be at a temperature of 100°C ±4 °C with the air re-circulator set in the range 80-100% recirculation in order to restore the temperature to 100°C ± 4°C as rapidly as possible. When the temperature is restored to 100°C ± 4°C the air regulator is set at 80% recirculation i.e., 20% fresh hot air. The air regulator is critical for even rapid drying. The samples are dried at 100°C ± 4°C for such time as is necessary for complete drying.

The dried sample is carefully removed from the drier as soon as the sample is cool enough for accurate weighing. The dry weight is recorded to one decimal place.

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

Moisture content determination by conductance moisture meter is not acceptable to the Testing Authority.

Section F – Trial design and data handling procedures

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 Trial Design and Data Handling Operator.
b) If any amendments to the plan have been made, return a hard copy of the plan to the Trial Design and Data Handling Operator with any amendments clearly indicated. Alternatively, amendments may be notified electronically with the agreement of the Trial Design and Data Handling Operator.

F.1.3 The Trial Design and 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 forwarded to the Trials Organiser.

F.3 Data processing

F.3.1. Processing of individual agronomic and disease variates.

F.3.2. A list of the agronomic, yield and disease variates, which may be recorded and processed, are specified in Sections C, D and E. After scrutiny, copies of the results will be returned to the Growing Trial Operator for action as agreed by the Trials Organiser

F.4 Other tests and trials

F4.1 Any additional or alternative designs required for the assessment of additional VCU characters not detailed in Annex I of the **MINOR CROPS VCU TRIAL PROTOCOL** will be added to these **Procedures** as and when approved by the NLSC.

Supporting Document for Appendices

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

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

Any enquiries regarding this publication should be sent to us at

webmaster@apha.gov.uk

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.