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 2026

Lupin

March 2025

Changes

- Updated year of document and date of last update

Contents

Section A – Summary of VCU trial assessments required

Type of character	Reference	Description of assessment	
Yield	Section C	**Untreated yield** **Moisture content**	
Impact of environment	Section C	**Standing ability** **Maturity**	*Straw Length*
Resistance to harmful organisms	Section D	None routinely assessed	
Quality characteristics	Section E	**Protein content**	

Further Measurements

The following must be measured or recorded in all trials, following procedures in Section C:

Sowing date
Plant population
Plot size
Pre-harvest shedding (where present at a level which will affect results)
Combine losses (where present at a level which will affect results)
Bird damage (where present at a level which will affect results)
Harvest date

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 The Seed Handling Operator must forward 200 g of the seed submitted of every variety in the trial, for authentication by the DUS test centre by the date specified by APHA responsible for carrying out the following seed handling procedures. The Trials Organiser will notify the minimum quantity required to Seed Handling Operators annually.

B.2.2 The Seed Handling Operator must retain a 100 g sample of seed of every variety until one month after harvest.

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 Soil type should be typical of those on which spring lupins are grown locally. Most lupins do not tolerate alkaline soil types and selected sites should be below pH7.0. 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.2.3 Previous cropping must be appropriate for lupin crops to be grown. Spring sown lupins are susceptible to *Sclerotinia sclerotiorum* and should not be grown following oilseed rape or linseed crops which have been infected with this disease or any other crop where *S. sclerotiorum* has been observed. A 4-year break should be used.

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 must not be less than 15 m^2 per replicate for trials with 4 replications and 25 m^2 per replicate for trials with 3 replications. Plots should be drilled to a greater length than required and cutback 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 target populations are as given in the following table:

Species	Type	Target seed rate (plants/m^2)
White lupins	Semi-determinate	35
Yellow lupins	Semi-determinate	70
Blue lupins	Indeterminate/semi-determinate	70
Blue lupins	determinate	100

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.

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 Trial Design and Data Handling Operator.

C.3.3.2 The trial must be sown according to the plan produced by the Trial Design and 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. The sub-blocks within a replicate must be sown adjacent to each other, as must plots within a sub-block. 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 Lupin varieties may differ considerably in height and determinacy according to type. To reduce competition effects between varieties a restricted neighbour randomisation design is used.

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 a standard control variety that is within the same grouping. 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 Drilling depth should be suitable to avoid damage by herbicides and birds.

C.3.4.3 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.

C.3.4.4 With restricted neighbour designs it is important that discard plots sown at the edges of the trial are similar in height to the adjacent trial plot.

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 one month of sowing 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 Trial Design and Data Handling Operator.

- Return a completed site data 1 sheet (provided by the Trials Organiser) 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 these features should utilise the navigation platform What3Words.com
- Trial sketch showing plot numbers and variety codes and/or names.
- A short post-establishment report of the condition of the trial.

C.4 Husbandry

C.4.1 **Agronomy**

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

C.4.2 **Fertiliser application**

It must 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, the corresponding advisory publications in England, Wales, Scotland and Northern Ireland and past trialling experience. Maintenance P and K dressings are permitted but no Nitrogen fertiliser should be applied. Seed must be inoculated with *Rhizobium* inoculant prior to drilling by the Growing Trial Operator.

C.4.3 **Herbicides**

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

C.4.4 **Growth regulators**

These should not be used on spring lupin trials.

C.4.5 **Pest and disease control**

C.4.5.1 **Pest control**

If necessary, approved means should be used to prevent or minimise damage by field mice, birds and other vertebrate pests.

C.4.5.2 **Disease control**

Lupin trials are normally conducted without fungicide treatment. Under certain conditions, however, severe disease infections can occur which threaten the trial. If diseases are present or expected and weather conditions favour further development (i.e. wet), an overall fungicide treatment should be applied. The Trials Organiser should be consulted.

C.4.6 **Irrigation**

Irrigation will only be permitted to facilitate establishment.

C.4.7 **Pathways**

Internal pathways should be made after the risk of pest 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. Harvest date should be timed when the trial is ripe and reflect local practice.

C.5.2 **Harvesting method:**

C.5.2.1 The Trials Organiser should be consulted if desiccation is considered necessary to facilitate harvest.

C.5.3 **Samples**

C.5.3.1 Samples are required from all plots for moisture content determination using the oven method and protein content determination.

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 Two samples from each plot must be taken at the time of plot weighing and sealed for moisture content determination by the oven method and protein content determination. A 1kg subsample will be required in a polyethene bag for oven moisture and a 1kg subsample in a cloth bag for protein. All harvest samples should be sent to the Quality Testing Operator as soon as practicable after harvest or after the completion of any drying where this is necessary.

C.5.3.3 All plot samples must be labelled with trial identification number, variety name/breeders' reference, AFP number, plot number and Growing Trial Operator identification number.

C.5.3.4 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 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 if there are any queries or ambiguities 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 Quality Testing Operator following the deadlines set out in Appendix 6.

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) a 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 Trial Design and Data Handling Operator in an approved format.

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 record this in any data file or hard copy medium as an asterix symbol (*) thereby indicating there is no recorded value associated with this plot.

C.6.2.6 Specific plot records must 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 VL decision-making.

C.6.3.1 **PLOT YIELD** **(OBLIGATORY)** **(kg)**

The plot yield must be recorded, and returned with details of harvested plot dimensions, the growth stage and dry matter content to the data handling operator within 5 days of harvesting the trial.

C.6.3.2 **STANDING ABILITY** **(OBLIGATORY)** **(1-9)**

This must be recorded on sequential occasions and at harvest time i.e. maturity. (1 – 9) for standing ability.

1 very poor
9 very good

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

Maturity should be judged by making a visual estimate of canopy senescence, where

1 Stem and pods green
9 Stem and pods bleached and brittle, seeds hard

C.6.3.4 **PROTEIN CONTENT** **(OBLIGATORY)** **(%)**

Protein content % of the harvested grain. See Section E.

C.6.3.5 **SOWING DATE** **(OBLIGATORY)** **(Day/month/year)**

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

C.6.3.6 **PLANT POPULATION/RECORDED AREA** **(OBLIGATORY)** **(No/m^2)**

Either of two methods can be used:

1. Take three or four random linear metre counts per plot from the middle rows. It is important that the row width and length measured (in metres) are entered after the character name so that the number of plants per m² can be calculated.

2. Count the plants within three or four quadrats per plot. The quadrats should be 0.25m to 1m² in size. The size used must be quoted.

3. Records will be converted and stored as number of plants per m².

Plant Population measurement is used to ensure target plant population is achieved. Records of Plant Population, which could affect the yield of trials, should accompany yield data.

C.6.3.7 **LENGTH AND WIDTH OF EACH PLOT** **(OBLIGATORY)** **(m)**

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 0.45m. The plot length harvested in metres.

C.6.3.8 **PRE-HARVEST SHEDDING from all plots** **(OBLIGATORY)** **(1-9)**

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

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

C.6.3.9 **COMBINE LOSSES** **from all plots** **(OBLIGATORY)** **(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 peas lost per m^2 for the lowest score given on the 1 to 9 scale.

C.6.3.10 **BIRD DAMAGE** **from all plots** **(OBLIGATORY)** **(1-9)**

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

C.6.3.11 *STRAW LENGTH* *(ADDITIONAL)* *(cm)*

Straw length should be measured on 5 or more randomly selected plants per plot after cessation of growth. The measurement must be the full length from ground level to the top of the extended main stem. The mean of the 5 plant measurements should be recorded.

C.6.3.12 **HARVEST DATE** **(OBLIGATORY)** **(Day/month/year)**

The date should be given numerically as day, month, and year.

C.6.3.13 **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 either as an estimate % plants affected, or as % leaf area attacked in accordance with the procedure in Section D for disease.

Records for other scores should be taken as % plants affected or on a 1 to 9 scale. Include definitions of 1 to 9 on the scale.

C.6.3.14 **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 given 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 **Disease Observation Plots**

No disease observation plots are carried out routinely.

D.1.2 **Naturally occurring disease in VCU growing trials**

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

D.1.3 **Diseases recorded**

D.1.3.1 Foliar diseases should be recorded when the level of infection on the most affected variety is over 5% of the leaf area.

D.1.3.2 Other pathogens should be recorded when more than 5% of the plants are affected. The percentage of plants infected should be recorded.

D.1.3.3 The precise timing for assessment is best judged in relation to the development of disease in the trial, with the aim being to achieve the assessment, which shows the most differentiation between varieties. In practice, this usually means that two or three sequential assessments are necessary. If disease infection persists, numerical records should be made throughout the season.

D.1.3.4All disease assessments must be sent to the Trial Design and Data Handling Operator as soon as they are made.

Section E – Quality testing procedures

E.1 Responsibilities

E.1.1 The Quality Testing Operator appointed by the Trials Organiser is responsible for conducting the 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**

E.2.1.1 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, and unthreshed pods and weed seeds. The cleaning may be by hand or with hand-held or mechanical sieves.

E.2.2 **Quality tests**

E.2.2.1 **Hammer milling of grain prior to analysis**

E.2.2.1.1 The mill must be a hammer mill fitted with a 1mm screen. 300 g of sample are 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.

E.2.2.1.2 After mixing, a representative sub-sample must be taken in the following manner:

- A sample jar of 250ml 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.2.2.2 **Determination of crude protein or total nitrogen content**

E.2.2.2.1 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.

E.2.2.2.2 Methods acceptable to the Testing Authority are currently total nitrogen determined by the Kjeldahl method and total nitrogen using the Dumas method.

E.2.2.2.3 These methods are only acceptable where instrumentation used is capable of analysing sample sizes greater than 0.5g.

E.2.2.2.4 Quality assurance of the analytical procedures should include regular analysis of a suitable test material, for example a sample of flour maintained for that purpose.

E.2.2.2.5 Systematic errors in Kjeldahl nitrogen analysis should 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.

E.2.2.2.6 Instrument drift in Dumas nitrogen should be controlled by standardisation against a suitable analytical standard (EDTA, Glycine), for which the nitrogen content is known.

E.2.2.3 **Moisture content determination**

The following procedure must be followed:

1. A fully representative sub-sample of approx 500 grams is weighed to 1 decimal place and then placed in the drier, which must be at a temperature of 100°C ± 4°C with the air recirculator 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 regulator is critical for rapid drying. The samples are dried at 100°C ± 4°C for such time as is necessary for complete drying.

2. 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.

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3. 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.1.1 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.1.2 The Trial Design and Data Handling Operator will check these for statistical validity.F.2 Data recording

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

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

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

F.3 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, 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

F.4.1 Any additional or alternative designs required for the assessment of additional VCU characters not detailed in Annex C 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

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www.gov.uk/apha

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