Animal & Plant Health Agency

United Kingdom Variety List Trials: Trial Procedures for Official Examination of Value for Cultivation and Use (VCU) Harvest 2022

Swede

Reviewed April 2022

Changes from Harvest 2021 VCU procedures

1. P2 B.2.1 — Changed from 50 g to 25 g.
2. p7, C.5.3.3 — Changed from ‘must be labelled with…’ to ‘should be clearly labelled’.
3. p10, C.6.3.10 — Swapped ‘very long’ and ‘very short’.
4. p11, C.6.3.14 — Swapped ‘smooth’ and ‘rough’.
5. p16, Appendix 1 — Removed ‘Elsoms Seeds Ltd’ from approved trial operators.
6. p19, Appendix 4 — Removed ‘Elsoms Seeds Ltd’

Contents

Section A – 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	**Dry matter yield**
Resistance to harmful organisms	Section D	**Powdery mildew %**
Behaviour with respect to factors in the physical environment.	Section C	**Plant population** **Bolting** *Early vigour* *Top size* *Neck length* *Root shape* *Root colour* *Skin texture* *Flesh colour* *Rotten roots* *Split roots*
Quality characteristics	Section E	**Dry matter content** *Colour retention* *Root uniformity* *Internal browning*

Further measurements

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

Sowing date
Harvest date
Plot size
Harvest losses (where present at levels which will affect results)
Fresh yield

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 25 g of untreated sample of the seed submitted of every candidate variety in the trial, for authentication by the DUS test centre by the date specified by APHA. The Trials Organiser will notify the minimum quantity required to Seed Handling Operators annually.

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

C.2.3 Soil type should be typical of those on which swede is 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 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 24m^2 per replicate and three replicates must be used. Plots should be drilled to a greater length than required and cut back to the required length prior to harvest. An example of plot set up to achieve the desired plot size is as follows:

Use an initial plot area of 10m long and 2 beds wide. Three rows are drilled on each bed (1.5m wide) with an inter-row width of approximately 0.35m. Three replicates should be sown to achieve an adequate plant population. Plots are trimmed to their final size of 8m long prior to harvesting.

C.3.2 **Plant population**

C.3.2.1 Seed will be drilled, and thinned if necessary, to give a plant spacing of 15cm to 20 cm and achieve an approximate plant population of 100,000 to 150,000 plants per/hectare.

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 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. The Trials Organiser will advise if this is the case.

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.

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 two rows of discard plots should be drilled on either side of the trial with the same drill and at the same time that the trial is drilled.

C.3.4.3 Precautions must be taken to avoid any missing rows. Any missing rows or parts of rows must be noted on the drilling plan 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 and spray application**

The precision application of chemicals post-drilling down the rows is permitted where appropriate, but wheelings within or between plots post drilling are not acceptable unless they consistently occur in the same place in each plot.

C.4.3 **Fertiliser application**

Applications of fertilisers 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.4.4 **Herbicides**

Chemicals must not be used if there are any known varietal sensitivities. If in doubt, the Trials Organiser should be consulted. Application should be across the direction of drilling.

C.4.5 **Pest and disease control**

C.4.5.1 **Pest control**

If necessary, approved means should be used to prevent or minimise pest damage. Grazing, particularly by pigeons, may be selective and control measures should be taken if necessary. Where there is a risk of significant flea beetle attack Growing Trial Operators must ensure that adequate pre- and post-emergence controls are taken.

If required and according to best local practice for the type of varieties being grown, the trial may be covered with “enviromesh” after early vigour and plant population scores are complete to prevent cabbage root fly infestation.

C.4.5.2 **Disease control**

Seedling diseases should be controlled by the routine seed-dressings used and viruses should be controlled by targeting their insect-vectors (see C.4.5.1 above).

C.4.6 **Irrigation**

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

C.4.7 **Pathways**

A gap (pathway) at the end of each plot of at least 1m is required to avoid carry-over of roots by the harvesting equipment. This should be created as late as is practicable. Rotavating or cultivating paths is best avoided because this can cause soft ground which in wet conditions may adversely affect harvesting. The use of hoeing, thistle bar or an appropriate herbicide is more suitable. If pathways have been cross drilled, this should be removed in good conditions leaving a level root free pathway.

C.4.8 **Plot assessment**

Plots should be assessed at the time of the population count to determine whether they are suitable for harvest. Weak plots may occur due to mechanical or varietal problems. If the problem is considered to be varietal the plots must remain as part of the trial. If the problem is considered to be mechanical the plots should either be treated as missing or as half plots.

Plots affected should be notified to the Trials Organiser at the time of detection

C.4.8.1 **Half plots - plots with gaps or poor uniformity may occur**

If plots have gaps due to mechanical or agronomic problems it may be necessary to eliminate the poor area by reducing the plot to a uniform length. Removal must be across all rows - whole rows cannot be discarded. These plots should be measured and pegged at the time of the population counts

C.4.8.2 **Missing plots - plots with gaps or poor uniformity may occur**

If plots are weak due to mechanical or agronomic problems throughout their entire length, it may be necessary to make the plots missing. These plots should be pegged at the time of the population counts and a symbol should be entered in subsequent data records (see C.6.2.5). The plots should be clearly indicated when the data is sent to the Trial Design and Data Handling Operator.

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. Trials should normally be harvested between October and January. A late November/January harvest is favoured in Scotland to maximise root development potential.

C.5.1.2 Plots should be trimmed to their final length prior to harvesting as described in C.4.7 above. 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**

C.5.2.1 All trials will be harvested by harvesting equipment approved by the Trials Organiser.

C.5.3 **Samples**

C.5.3.1 Root samples should be taken for dry matter determination by coring. A representative sample of root cores is taken through the centres of a minimum of 20 roots in the harvest rows of each plot and any adhering soil is removed. The sample is identified with a label and placed in a polythene bag which is immediately sealed. The samples must be brought to the laboratory as soon as possible after coring.

C.5.3.2 The samples should be delivered to the appropriate Quality Testing Operator as soon as practical after harvest.

C.5.3.3 All plot samples should be clearly labelled, so that they are clearly identifiable to the Growing Trial Operator.

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 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.5.4.3 All samples should be sent to the Quality Testing Operator following the deadlines set out in Appendix 6.

C.6 Records

Records should be clear and self-explanatory so that the trial can be carried on at a moments notice by another person without difficulty.

C.6.1 There are four components:

1.	Diary	Field notes of trial status, recording and inspections
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 on every trial 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 using the measure names and units as listed in Section C.6.3.

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 identified 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 a 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**

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 (OBLIGATORY) (Day/month/year)**

This is recorded in Part 1 of the Site Information Form

C.6.3.3 **FRESH YIELD from all plots (OBLIGATORY) (kg)**

Enter the total harvested weight in kg per plot and provide the harvested plot dimensions with the record. If the plot lengths or widths are not constant then these dimensions must be provided along with the results.

C.6.3.4 **DRY MATTER WEIGHT from all plots (OBLIGATORY) (kg)**

A detailed protocol for the assessment of dry matter content of roots is given in Section E. Also specify the fresh weight taken for the sample (FRESH SAMPLE WT, FRESH WT). If the figures are DM% then enter the fresh weight of sample as 100.

C.6.3.5 **PLANT POPULATION from all plots (OBLIGATORY) (Count)**

Record the number of plants in the plot at harvest including any rotten, cracked or bolted plants. Record the plot length counted and indicate any rows that have a low population.

C.6.3.6 **BOLTER NUMBER from all plots (OBLIGATORY) (Count)**

Count the number of bolters in each plot at harvest in the total harvest plot area.

C.6.3.7 **POWDERY MILDEW from all plots (OBLIGATORY IF PRESENT)(%)**

Record if the most affected variety has over 5% of the leaf area affected using the foliar disease assessment key in Appendix 8.

C.6.3.8 **HARVEST DATE (OBLIGATORY)(Day/month/year)**

This is recorded in Part 2 of the Site Information Form

C.6.3.9 *EARLY VIGOUR* *from all plots* *(ADDITIONAL)* *(1-9)*

Record on the basis of relative plant size in on the scale:

1 = very small
9 = very large

Record the size of the plants at each end of the scale.

C.6.3.10 *NECK LENGTH* *from all plots* *(ADDITIONAL)* *(1-9)*

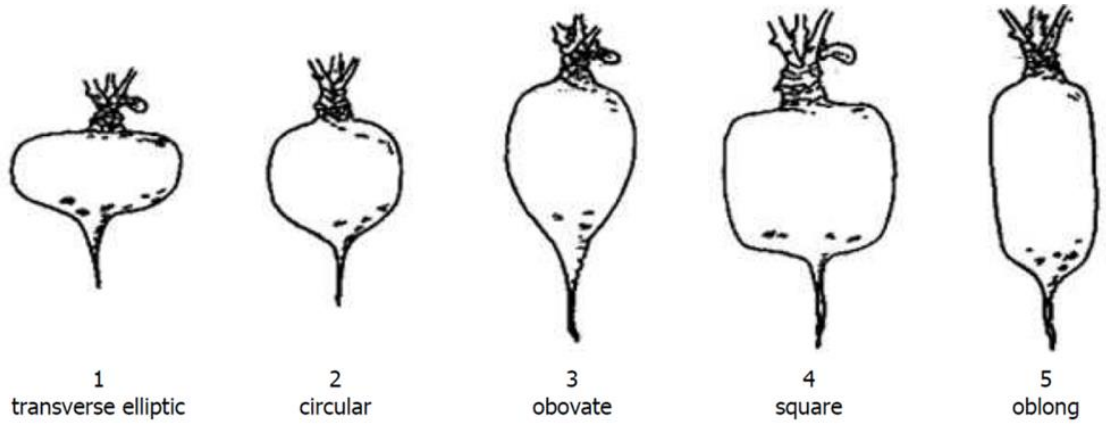
Assess just before harvest on the scale:

1 = very short
9 = very long

If areas of the trial become severely affected by drought, these should be recorded on a trial layout and returned to the Trial Design and Data Handling Operator as soon as possible. The Trials Organiser should also be informed.

C.6.3.11 *ROOT SHAPE* *from all plots* *(ADDITIONAL)* *(1-5)*

Record the most common root shape in each plot after the roots have been lifted using the key below:



C.6.3.12 *TOP SIZE* *from all plots* *(ADDITIONAL)* *(1-9)*

Score the relative top size of each plot just before harvest on the scale:

1 = very small
9 = very large

Give also an indication of the approximate top size (height and spread) for the extreme values recorded.

C.6.3.13 *ROOT COLOUR* *from all plots* *(ADDITIONAL)* *(1-9)*

Record the most common root colour in each plot after the roots have been lifted using the scale below:

1 = green
3 = bronze
5 = pink
7 = light purple
9 = dark purple

C.6.3.14 *SKIN TEXTURE* *from all plots* *(ADDITIONAL)* *(1-9)*

Score on the scale:
1 = smooth
9 = rough

C.6.3.15 *FLESH COLOUR* *from all plots* *(ADDITIONAL)* *(1-9)*

Score on the scale:
1 = white
5 = cream
9 = yellow

C.6.3.16 *ROTTEN ROOT NUMBER* *from all plots* *(ADDITIONAL)* *(Count)*

Record the number of rotten roots in the harvest area of each plot and exclude these from the plot weight.

C.6.3.17 *SPLIT ROOT NUMBER* *from all plots* *(ADDITIONAL)* *(Count)*

Record the number of roots with splits greater than 5 mm in depth in the harvest area of each plot. Split roots should be **included** in the plot weight.

C.6.3.18 *COLOUR RETENTION* *from all plots* *(ADDITIONAL)* *(1-5)*

An assessment of the ability of the variety to withstand bleeding out is made as follows. A sample of 10 roots is taken from each plot and rubbed with a damp cloth. The level of bleeding observed is assessed on a 1-5 scale.
1 = Heavy bleeding
5 = No bleeding

C.6.3.19 *ROOT UNIFORMITY* *from all plots* *(ADDITIONAL)* (%)

Assess the % of roots falling within the size category 500-600 g. The % larger and smaller than this weight is also recorded.

C.6.3.20 *INTERNAL BROWNING from all plots (ADDITIONAL) (1-5)*

Internal browning would be assessed as follows. 10 roots would be selected at random at harvest and cut open to examine internal browning. Internal browning will be assessed on a 1-5 scale.

1 = High levels of internal browning
5 = No internal browning

C.6.3.21 **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 estimated % of 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 % of plants affected or on a 1 to 9 scale. Include definitions of 1 to 9 on the scale.

C.6.3.22 **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 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 Naturally occurring disease is normally recorded in the growing trials. Confirmation of the identity of a disease should be obtained from an appropriate plant pathologist if required.

D.1.3.2 **Recording methods**

D.1.3.3 Diseases are assessed using the timings and appropriate assessment keys given in Appendix 8. All disease records to be sent to the appropriate Trial Design and Data Handling Operator as soon as they are made.

D.2 Inoculated disease tests

No inoculated disease tests are carried out routinely

Section E – Quality test 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. The Growing Trial Operators are responsible for producing representative samples for quality assessment as indicated in Section C.

E.2 Quality Assessment Methodology

E.2.1 **Dry weight determination**

The treatment of samples and the time interval between cutting and weighing should be such that there is no significant moisture loss between the weighing of the plot fresh yield and the weighing of the fresh weight of the sample.

Samples to determine dry matter content should be taken by coring. A fully representative sub-sample is taken through the centre of at least 20 roots from each plot, to achieve a minimum sub-sample of 500g. These samples are either immediately weighed in the field of taken to the laboratory for weighing. If the latter option is followed the samples should be sealed in a moisture proof container and kept out of direct sunlight and as cool as possible until weighing. Each sample must be identified with a label. The remaining roots are then harvested to determine the fresh weight for each plot.

The cored sub-samples are 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 ie 20% fresh hot air. The air regulator is critical for even rapid drying. The samples are dried for such time as is necessary for complete drying.

The dried samples are carefully removed from the drier as soon as they are cool enough for accurate weighing. The dry weight is recorded to one decimal place. When the dry weights are reported as a percentage, the fresh weight should be reported as 100.

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 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, cultivations, 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

F.4.1 Any additional or alternative designs required for the assessment of additional VCU characters not detailed in Annex F of the **MINOR CROPS VCU TRIAL PROTOCOL** will be added to these **Procedures** as and when approved by the NLSC.

Appendix 1 – Approved Trial Organisers/ Operators for swede

Activity	Organisers/Operators responsible
Trials Organiser	BSPB
Trial Design and Data Handling Operator	NIAB
Growing Trial Operator	SASA
Seed Handling Operator	NIAB
Trial Inspection and Technical Validation Operators	SASA/NIAB
Quality Testing Operator	SASA
Data Review and Standard Setting Operator	NIAB

Appendix 2 – Seed treatment products for use on NL trials

Approved seed dressings to be applied according to current Regulations and must be approved by the Trials Organiser.

Appendix 3 – Seed despatch deadline dates for swede

VCU seed must be delivered to the Seed Handling Operator by 15th February and to the VCU sample Authentication Centre by 1st March.

Appendix 4 – Growing Trial Operators and Trial locations

Growing Trial Operator	Seed Handling Operator (If not trial operator)	Location of trial
SASA	NIAB	Edinburgh, Scotland

Appendix 5 – Control varieties for VCU assessments for swede

Ruta Øtofte
Magres
Helenor
Gowrie

Appendix 6 – Dates for submission of records

A. To Trials Organiser

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

B. To Data Handling Operator

Record	Date
Plot records should be sent to Data Handling Operator	Within 10 days of record being taken

C. To Quality Testing Operator

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

Appendix 7 – Growth stages of swede

	Growth Stage	
Germination and Emergence	00	Dry seed
	0-10	Germination and emergence through soil
Seedling growth	12	Elongation of emerging shoot
	15	Elongation and opening of cotyledons
	20	Cotyledons fully opened
	30	Cotyledons fully opened and full development of first true leaf
	40	Second leaf fully developed
	50	Third leaf fully developed and initial senescence of cotyledons
	60	Fourth leaf fully developed and partial senescence of cotyledons
	70	Fifth leaf fully developed and advanced senescence/drop of cotyledons
Leaf development	80	Sixth leaf fully developed
	90	Seventh leaf fully developed; initial senescence of first true leaf in early cultivars
	100	Eighth leaf fully developed; 30 % senescence of first true leaf
	110	Ninth leaf fully developed; 60% senescence of first true leaf
	120	Tenth leaf fully developed; complete senescence and drop of first true leaf
	130	Eleventh leaf fully developed
	140	
	150	Few leaf scars becoming exposed on root ‘neck’
	160	
	170	
	180	Many leaf scars exposed on root ‘neck’

Root development	200	Slight swelling of the root at ground level
	220	Development of a small swollen root above ground level
	240	Swollen root medium
	260	Root fully developed with no cork on skin
	270	Root fully developed with 40% cork development on skin
	280	Root fully developed with 80 - 100% cork development
	290	Root flesh becoming pithy and fibrous
	299	Root flesh fibrous and pithy
Flowering	400	First flower open on terminal raceme
	410	Few flowers are open on terminal raceme
	420	Full flowering; lower siliques are elongating
	450	Lower siliques are starting to fill, less than 5% of flower buds are not yet open
	470	Seeds in lower siliques are enlarging, all buds have opened

Appendix 8 – Assessment keys for swede diseases

Leaf diseases

1.	Examine leaves in 3 areas of each plot.
2.	Include all necrosis and chlorosis attributable to disease to be assessed.
3.	Estimate % infection using the description below, interpolating values if necessary.
4.	Record the average % infection from the 3 areas.

Infection disease severity description

0	No infection observed.
0.1	Older leaves with a trace of infection, other leaves uninfected.
1	Older leaves with up to 10% infection, other leaves largely uninfected.
5	Older leaves with up to 25% infection, middle aged leaves with a trace of infection.
10	Older and middleaged leaves with up to 25% infection, young leaves largely uninfected.
25	Leaves of all ages appear 50% infected 50% green on average.
50	Leaves of all ages appear more infected than green on average.
75	Very little green tissues left.
100	No green tissue left.

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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.