Animal &
Plant Health
Agency

United Kingdom Variety List Trials:

Trial Procedures for Official Examination of Value for Cultivation and Use (VCU)

Harvest 2025

Potato

June 2024

Contents

Changes from Harvest 2024 VCU procedures

A.3.2.1 Team email change from telephone number

A.6 Removal of reference to *G. pallida* Pa1

C.2.6 Removal of *Globodera* pallida Pa1

C.2.6.1. Removal of both references to *Globodera pallida* Pa1

C.2.6.2 Updated definition of basis of second year testing

C.2.6.2 Removal of *G. pallida* Pa 1 testing

Section A – General information

1 Purpose

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 Potato**.

2 Scope

A.2.1 These procedures apply to all varieties of **Potato.**

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

Variety Testing and Genetic Resources Manager
Potato Branch
SASA
Roddinglaw Road
Edinburgh
EH12 9FJ Email: potatovarietytesting@sasa.gov.scot

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

A.3.2.3 Growing Trial Operators and Pathology Trial Operators

The Trials Organiser is responsible for identifying the Growing Trial Operators and Pathology Trial Operators to carry out trials and tests as determined by the Procedures Development Group's annual review in accordance with the **VCU Protocol**, and these **Procedures**.

A.3.2.4 Data Handling Operator

The Trials Organiser is responsible for identifying the Data Handling Operator who will validate and analyse data in accordance with **VCU Protocol** and associated **Procedures.**

A.3.2.5 Seed Handling Operators

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 planting on behalf of any Growing Trial and Pathology Trial Operators in accordance with the **VCU Protocol** and these **Procedures**.

A.3.2.6 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 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 action 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 A.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.

4 Procedures for applications and seed delivery

A.4.1 The latest date for receipt of applications for acceptance of a variety onto the National List, which is set administratively by APHA, is 15 December. Applications received after this date may be considered for inclusion in the current year’s tests and trials on a case-by-case basis.

A.4.2 Applications, together with the completed Technical Questionnaire (TQ) should be Sent - through the UPOV PRISMA platform.

Payment of the administration fee (£450 for each application) will be invoiced after the application stage

A.4.3 The latest date for receipt of seed, which is set administratively by APHA, is 15 January. Receipt of seed after this date is normally refused. Any acceptance of seed received after this date will be determined by APHA after consultation with the Trials Organiser who will send instructions for the delivery of seed to applicants.

A.4.4 The number of tubers required each year is 600, of which 50 are for DUS testing.

A.4.5 Seed tubers derived in the UK must be from field-grown seed crops which satisfy the conditions for Approved Stock as set out by SGDARE (Potato Branch, SASA, Roddinglaw Road, Edinburgh EH12 9FJ), APHA (Plant Health Division, Sand Hutton, York YO41 1LZ) and DAERA (Farm Policy Branch, Room 910, Dundonald House, Belfast BT4 3SP). Each package or container holding the seed tubers submitted for trials should be accompanied by a UK plant passport and be sealed by part of the plant passport/label.

A.4.6 Seed tubers submitted for trials from stocks grown in the European Union should be accompanied by a phytosanitary certificate. Each package or container holding the seed tubers submitted for trials should be officially sealed the phytosanitary certificate should also confirm that the tubers belong to Advanced Selections.

A.4.7 Seed tubers must be size graded 30mm x 50mm, in sound condition, substantially free from soil and not visibly unfit for planting by reason of mechanical damage, attack by any insect, pest, disease or any other condition which would impair subsequent growth. Tubers must be delivered in new sacks or other new containers and must not have been chemically treated.

A.4.8 Applicants wishing to submit varieties which have been propagated within the European Union and which do not meet the requirements for the issue of a phytosanitary certificate may apply for an import licence under Article 40 of the Plant Health (Scotland) Order 2005 (as amended). Any import licence granted will be subject to conditions and a copy must accompany the seed tubers.

A.4.9 Applicants wishing to submit varieties which have been bred outside the European Union must initially apply for a licence under the Plant Health (Scotland) Order 2005 (as amended) to bring a restricted number of tubers through quarantine. Only the produce of these tubers further multiplied in the European Union will be eligible for tests and trials.

5 Authentication of seed stocks

A.5.1 Year 1 VCU and DUS submissions are taken from the single submitted seed lot.

In the event of deterioration of seed prior to planting, replacement tubers may be acceptable provided that they are from the same stock, and will, in the opinion of the Trials Organiser, not affect the assessments.

A.5.2 Year 2 and any further VCU seed submissions are authenticated according to the procedures set out in associated document **DUS POTATO PROCEDURES.**

A.5.3 If the level of off types or of a different variety recorded in DUS tests or VCU authentication of a candidate variety exceeds 10%, the VCU data will be considered invalid.

A.5.4 If the incidence of disease in tubers or growing crop is excessive then the trials will be considered invalid.

6 Assessments to be made in VCU trials

Bold = Obligatory *Italics = Additional only if requested by an applicant*

Type of Character	Reference	Description of assessment
1. Yield	Section B	**Plot yield (> and < 35 mm)**
2. Behaviour with respect to factors in the physical environment	Section B	**Susceptibility to damage: external and internal damage** **Produce of growing trial assessed for physiological faults e.g., misshapes, growth cracks, hollow heart, rust spot and internal blemishes and fractions weighed (kg)**

Type of Character	Reference	Description of assessment
3. Resistance to harmful organisms	Section C	**Foliage late blight** **Tuber late blight** **Blackleg *(Pectobacterium atrosepticum)*** **Common scab** **Powdery scab** **Potato cyst nematode (*G. rostochiensis* Ro 1 and *G. pallida* Pa2/3)** **Dry rot *(F. coeruleum*)** **Dry rot (*F. sulphureum)*** **PVA** **PVY^{N}** **PVY$^{N\text{-Wilga}}$** **Leafroll** **Produce of growing trial assessed for damage caused by harvester, slugs, wireworms, cutworms, rots and common scab (> 25% cover) and each fraction weighed (kg)**

Type of Character	Reference	Description of assessment
4. Quality	Section D	**Cooking quality (off-flavour and discolouration on steamed samples)** **Crisp quality (colour)** **French fry quality (Colour and colour uniformity)** **Baking quality** **Specific gravity** **Tuber shape** **Skin texture** **Uniformity of tuber shape and size**

Section B – Growing trial procedures

1 Responsibilities

B.1.1 The Growing Trial Operator is responsible for conducting the trial according to these procedures.

2 Site selection

B.2.1 The Growing Trial Operator is responsible for identifying a suitable site which meets the following criteria:

B.2.1.1 Previous cropping should be appropriate for a potato crop to be grown.

B.2.1.2 Soil type should be typical of those on which potatoes are grown locally. The soil should be sufficiently uniform to avoid variation in the growth of plants.

B.2.1.3 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.

B.2.1.4 Cultivations should follow best local practice.

3 Planting the trial

B.3.1 Plot size

Plots should comprise at least 3 drills with no gaps lengthwise between the plots. The trial should be bounded by discard material to avoid edge effects in the growing trial.

B.3.2 Planting

B.3.2.1 Plant population

Seed tubers should be spaced 25 to 35 cm apart for first earlies and 30 to 40 cm apart for second earlies and maincrops.

B.3.2.2 Plot layout

Varieties should be grouped according to maturity class i.e., first earlies, or second earlies and maincrops. The varieties should be allocated at random to the plots.

4 Husbandry

B.4.1 Agronomy

Where not specified in these procedures, agronomy should follow best local practice.

B.4.2 Application of fertilisers, herbicides and pesticides

Applications of fertilisers should be uniform and are normally made across the direction of the plots. All fertiliser applications should take account of the Nutrient Management Guide (RB209), the corresponding advisory publications in England, Wales, Scotland and Northern Ireland and past trialling experience. The application of chemicals post planting is permitted where appropriate, but wheelings within or between plots are not acceptable. Wheelings should be confined to blank drills surrounding trial. Control of diseases and pests, e.g., late blight, should follow best local practice.

B.4.3 Irrigation

Irrigation is applied as required according to best local practice.

5 Harvesting

B.5.1 Timing of harvesting

Plots will be harvested at full foliage maturity (first earlies) or at least 2 weeks after haulm destruction (second earlies and maincrops). Plants affected by virus or blackleg and those of other varieties and genetic variants must be excluded from the trial harvest, preferably by removal just prior to harvest of the trial.

B.5.2 Harvesting method

The produce of at least 16 plants in each plot, normally from the centre drill, should be harvested by machine in order to obtain an assessment of damage attributable to mechanical harvesting. After harvest, the produce will be passed over a 35 mm riddle and the unmarketable fraction removed and divided into 11 categories (Appendix 4).

6 Control varieties

These are listed in Appendix 2. Control varieties should be requested by Growing Trial Operator in advance of harvesting to allow required number of tubers to be retained for despatch.

7 Records

B.7.1 Plot records should be sent in an agreed electronic format or as record sheets (Appendix 4) and submitted by dates shown in Appendix 3.

B.7.2 If a character is not recorded or is missing, the reason should be noted on the recording sheet.

B.7.3 Specific plot records should be made on the scales shown in Section B 7.4. Plants of other varieties, genetic variants and those affected by virus or blackleg should also be noted.

B.7.4 Characters recorded:

B.7.4.1 **TUBER YIELD** **(OBLIGATORY)**

The weight of tubers >35 mm and < 35 mm is recorded in kg as set out in B.5.2.

B.7.4.2 **EXTERNAL TUBER DEFECTS** **(OBLIGATORY)**

Unmarketable tubers are divided into 11 categories: growth cracks, greens, misshapes, mechanical damage, cutworms, wireworms, common scab >25% surface area covered, late blight, wet rots, slugs and other faults. The weight of each category is recorded in kg.

B.7.4.3 **INTERNAL TUBER DEFECTS** **(OBLIGATORY)**

The number of tubers with hollow heart, internal blemishes or other defects is recorded by cutting, initially, 25 tubers. If any faults are found in this sample, a further 25 tubers are cut.

B.7.4.4 *TUBER SHAPE* (*ADDITIONAL*, recorded during DUS testing)

Estimate the average shape of the tuber of the produce of the plot using the scale:

1 = round
2 = short oval
3 = oval
4 = long-oval
5 = long
6 = very long

B.7.4.5 *TUBER SHAPE UNIFORMITY* (*ADDITIONAL*)

Estimate the overall uniformity of tuber shape of the produce of the plot using the scale:

1 = poor,
9 = excellent

B.7.4.6 *SIZE* *(ADDITIONAL)*

Estimate the average tuber size of the produce of the plots using the scale:

1 = < 35mm
9 = > 85mm

B.7.4.7 *SIZE UNIFORMITY* *(ADDITIONAL)*

Estimate the overall tuber size uniformity of the produce of the plot using the scale:

1 = poor,
9 = excellent

B.7.4.8 *SKIN TEXTURE* *(ADDITIONAL*, recorded during DUS testing*)*

Estimate the skin texture of the tubers of the produce of the plot using the scale*:*

1 = smooth,
2 = medium
3 = rough

B.7.4.9 Site Factors

Any observations of the trial which may have an effect on plots must be recorded.

Section C – Pathology test procedures

1 Responsibilities

C.1.1 The Pathology Trial Operators are responsible for conducting the tests according to these procedures.

C.1.2 Growing trial plots
There are no specific plots for disease observation. Naturally occurring disease in the growing trial should be noted by the Growing Trial Operator (Section B.7.3).

2 Pathology tests

C.2.1 **Blackleg (*Pectobacterium atrosepticum,* formerly** *Erwinia carotovora* subsp *atroseptica*)

C.2.1.1 Methodology

Susceptibility to blackleg (*Pectobacterium atrosepticum)* is assessed by a method similar to that described by D. H. Lapwood & P. T. Gans (1984. *Annals of Applied Biology* **104**: 315-320). Prior to planting, 60 seed tubers of each variety are stab inoculated with *P. atrosepticum* at the stolon end to a depth of *c.* 2 cm with the eye of a darning needle containing *c.* 0.01 - 0.02 ml of a bacterial suspension of a mixture of isolates at 10^9 cells ml $^{-1}$. Tubers may be stored overnight at *c.* 5 ^{o}C until planting.

C.2.1.2 Plot size and trial design

Each plot consists of a maximum of 10 inoculated tubers. The trial will be laid out in a fully randomised block design with 6 replicates.

C.2.1.3 Cultivation

Tubers are planted 30 to 40 cm apart in the drills. Husbandry regarding weed, disease and pest control should follow best local practice. If required, irrigation should be applied to maintain soil moisture at or near field capacity from shortly after emergence to mid-July.

C.2.1.4 Disease assessment

The number of missing plants in each plot is recorded after all plants appear to have emerged. On 2 or 3 dates between June and August, the number of plants showing blackleg symptoms (stem rot or wilting) is recorded for each plot.

C.2.1.5 Submission of data

The number of plants missing or affected by blackleg should be expressed as a percentage of inoculated tubers in a plot.

Trial results must be returned to the Trials Organiser by 15 November.

C.2.2 **Late blight *(Phytophthora infestans)***

C.2.2.1 **Foliage late blight**

C.2.2.2 Methodology

Plants will be grown in small plots and will be exposed naturally to inoculum of a known R-gene complex isolate of *P. infestans* from infected plants surrounding the test plants.

The isolate used to test the varieties will be tested for virulence to R-genes on set of single R-gene differentials R1-R11 at the start of testing season. Tubers cv. King Edward will be planted in pots, c. 9 cm in diameter, and grown in a glasshouse for 4-5 weeks. Plants will be inoculated by spraying them lightly with a zoospore suspension derived from a chilled suspension of 10^3 sporangia ml $^{-1}$. Plants will be immediately placed in a controlled environment chamber at c. 15 ^{O}C and high humidity for 2 days before reducing relative humidity to c 80%. When lesions are visible, the infector plants will be laid sideways along the spreader rows of cv. King Edward at 1-2 m intervals.

C.2.2.3 Plot size and trial design

Tubers of cv King Edward will be planted c 48 cm apart in rows on either side of test plots. Two tubers of cv King Edward will also be planted in each row at the either end of a block. All varieties will be planted around middle of May. In addition, one plot of each of the single R-gene differentials for R1-R11 and the differential R1,2,3,4 will be planted beside the experiments to check the virulence of the isolates in the experiment.

The experiments will be laid out in a fully randomised block design with 4 replications. Each plot will consist of 2 tubers planted c. 45 cm apart along the drill. Plots will be confined to 2 rows. First early varieties will be planted in a separate experiment from other varieties.

C.2.2.4 Cultivation

Soil is a medium loam. A compound fertiliser will be applied, taking account of the Nutrient Management Guide (RB209), to the site before ridging. If slurry is applied this should be done during the winter prior to trialling, following any NVZ guidelines, GAEC etc. Herbicide will be applied by sprayer just before emergence to kill germinating weeds. Drills will be spaced c. 30 cm apart.

C.2.2.5 Disease assessment

The percentage foliage affected by late blight will be assessed visually on a 1-9 scale using the diagrammatic key of Cruickshank et al. (1982. *Potato Research* 25: 213-214.). Recordings will be made on at least 3 occasions with the first assessment being made shortly after the initiation of disease development and the last when disease is well developed on most varieties.

Each score will be expressed as the mid-point percentage value and Area Under Disease Progress Curve calculated according to Fry (1978. *Phytopathology* 68: 1650-1655) and angularly transformed for statistical analysis.

C.2.2.6 Submission of data

The percentage foliage affected by late blight on each occasion will be assessed visually as a 1-9 scale (Appendix 5) in which 9 = no infection.

Trial results must be returned to the Trials Organiser by 15 November.

C.2.2.7 **Tuber late blight**

C.2.2.8 Methodology

Susceptibility to tuber late blight (*Phytophthora infestans*) is assessed by methods similar to those described by H. E. Stewart, D. C. McCalmont & R.L.Wastie (1983. *Potato Research* 30: 533-538). All tests are conducted using an isolate of *P. infestans* which contains as many R-gene virulence factors as possible. Care is taken to avoid damaging the tubers when they are lifted by hand from the field trial and transported to the incubation chamber. Excess soil is removed by lightly spraying tubers with water before placing them rose-end uppermost in trays. Tubers are sprayed with a zoospore suspension of *c.*2.5 x 10^4 zoospores ml^{-1} or one derived from a concentration of the order of 10^4 sporangia ml^{-1}. After incubation at *c.* 15^{o}C and high humidity for a few days, the tubers are moved to ambient storage.

C.2.2.9 Plot size and trial design

First earlies should be grouped separately from second earlies and maincrops and each planted in a randomised block layout with 2 replicates. Test tubers are lifted on 2 occasions with an interval of *c.* 2-3 weeks. On each harvest date, *c.* 20 tubers are harvested from each plot.

C.2.2.10 Cultivation

Seed tubers are planted *c.* 30cm apart. Husbandry should follow best local practice. If necessary, blight control should be affected using a protectant fungicide.

C.2.2.11 Disease assessment

The number of tubers affected by blight at points other than the stolon scar or damaged tissue is assessed 12 to 15 days after inoculation.

C.2.2.12 Submission of data

The plot records should be expressed as a percentage.

Trial results must be returned to the Trials Organiser by 15 November.

C.2.3 **Common scab (*Streptomyces* spp.)**

C.2.3.1 Methodology

Susceptibility to common scab (*Streptomyces* spp.) is assessed by planting seed tubers in pots containing artificially infested compost diluted with sand (P. D. S. Caligari & R. L. Wastie, 1985. *Potato Research* **28**: 379-387). Isolate(s) of *S. scabies* are grown for 3-4 weeks on Potato Dextrose Agar or Malt Extract Agar. The petri-dish cultures are comminuted in distilled water and mixed with the compost: sand mixture at the rate of 1 dish per 6 litres of the mixture.

C.2.3.2 Plot size and trial design

Pots are laid out in a fully randomised block design with at least 4 replications. Each plot consists of 2-3 pots.

C.2.3.3 Cultivations

Plant spacing is not critical but should be standard. The pots, *c.* 15-26 cm in diameter, are placed in polytunnels and watered overhead until plants are *c.* 15cm high, after which water is only supplied around the base of the pots by trickle irrigation.

C.2.3.4 Disease assessment

The proportion of surface area affected is assessed using a visual key (Manual of plant growth stages and disease assessment keys, MAFF, ADAS, 1976) (Appendix 6). The diagrams are used as boundaries for the individual classes of disease severity.

Class	I	II	III	IV	V	VI	VII
% Surface area	0	0-5	5-10	10-25	25-50	50-75	75-100
Mid-point value	0	2.5	7.5	12.5	37.5	62.5	87.5

The produce of each plot is divided into these classes. The mean % surface area affected is calculated by dividing the sum of the number of tubers in each class multiplied by the class mid-point value by the total number of tubers assessed.

C.2.3.5 Submission of data

Trial results must be returned to the Trials Organiser by 15 November.

C.2.4 **Powdery scab *(Spongospora subterranea)***

C.2.4.1 Methodology

Susceptibility to powdery scab (*Spongospora subterranea*) is assessed by planting seed tubers in artificially infested soil and by controlling soil moisture during tuber initiation. Inoculum for the pot test is prepared by peeling and scraping scab lesions, and then drying and macerating the peelings.

C.2.4.2 Plot size and trial design

Each plot consists of 1 pot laid out in a fully randomised block design of 7 replicates.

C.2.4.3 Cultivation

Seed tubers are planted in pots, *c.* 20-26cm in diameter, with *c.* 0.3g of macerated scab lesions mixed into the top layer of the compost. Compost is kept moist until all plants have emerged, after which it is maintained near field capacity for 4 days followed by no applications of water for 3 days. This cycle is repeated throughout the period of tuber initiation, normally until 7 weeks after emergence; thereafter, the compost is kept moist to ensure good plant growth.

C.2.4.4 Disease assessment

The proportion of surface area affected is assessed in 6 categories shown below, using a visual key (Manual of plant growth stages and disease assessment keys, MAFF, ADAS, 1976) (Appendix 6). The diagrams are used as boundaries for the individual classes of disease severity.

Class	I	II	III	IV	V	VI
% Surface area	0	0-5	5-10	10-25	25-50	50-100
Mid-point value	0	2.5	7.5	17.5	37.5	75

The mean % surface area affected is calculated by dividing the sum of the number of tubers in each class multiplied by the class mid-point value by the total number of tubers assessed.

C.2.4.5 Submission of data

Trial results must be returned to the Trials Organiser by 15 November.

C.2.5 Potato virus Y (separate tests for resistance to strains $PVY^{N\text{-}Wilga}$ and PNY^{N}), Potato virus A (PVA) and Potato leafroll virus (PLRV).

C.2.5.1 Methodology

Susceptibility to these aphid-borne viruses is assessed by planting infected tubers within the test and by subsequently measuring the amount of virus infection in the test plants at the end of the growing period.

C.2.5.2 Plot Size and trial design

Two trials will be sown. For **PVY$^{N\text{-}Wilga}$** and PLRV, a plot consists of two rows, each of 5 tubers of a test variety, with a tuber infected with PLRV at each end and 1 row of tubers infected with **PVY$^{N\text{-}Wilga}$** to one side of each plot. The plots are laid out in a randomised block design with 4 replicates. For PVY^{N} and PVA a plot consists of two rows, each of 5 tubers of a test variety, with 1 row of tubers infected with PVY^{N} to one side of each plot and one infected with PVA to the other side of each plot. The plots are laid out in a randomised block design with 4 replicates.

C.2.5.3 Cultivations

Seed tubers are spaced 45 to 55 cm apart. Cultivations and crop husbandry should follow best local practice but there should be no aphid control. The haulm is destroyed chemically between August and September and tubers harvested as soon as possible after haulm necrosis. One tuber is then collected from each test plant and stored in the dark in dry warm conditions after treating with a hormone to break dormancy.

C.2.5.4 Disease assessment

When sprouts are produced, an eye plug is taken from each tuber and planted in a seed tray filled with peat based compost. When plants have sufficient foliage, each one is tested individually by the ELISA method and the number of plants (tubers) infected with each virus is recorded. Antisera for PVY should be able to detect **PVY$^{N\text{-}Wilga}$** strains in one test, and PVY^{N} in the other test.

C.2.5.5 Submission of data

The plot records should be expressed as a percentage of number of test plants.

Trial results must be returned to the Trials Organiser by 15 April.

C.2.6 **Potato cyst nematode (*Globodera rostochiensis* (Ro1) and *Globodera pallida* (Pa2/3))**

C.2.6.1 Methodology

Susceptibility to *Globodera rostochiensis* Ro1 and *Globodera pallida* Pa2/3 is assessed by planting seed tubers in artificially infested compost. Standard populations of the pathotypes of *G. rostochiensis* (Ro1: population Ecosse) and *G. pallida* (Pa2/3: population Chavornay) are maintained at SASA on plants of cvs Desiree and Maris Piper respectively. The virulence of all populations is checked regularly on selected clones. An estimate of mean number of eggs in the cysts is made and the inoculum mixed to give a soil infestation of *c.* 5 eggs g^{-1} compost.

C.2.6.2 Plot Size and trial design

For each pathotype, the pots are laid out in a randomised block design with 4 replicates in each test.

For *G. rostochiensis* Ro1 and *G. pallida* Pa 2/3, all varieties will be tested in year 1 with 4 replications and, in year 2, only those varieties showing a resistance score of 2.8 or greater will be tested. There will be two pots per block of each of the control varieties.

Candidate resistance score = 2 + ln (Average of control varieties / Candidate) / ln(2)

based on over-trials geometric means of cysts produced for varieties and where “ln” denotes the natural logarithm function.

C.2.6.3 Cultivations

Seed tubers or seed pieces are planted in pots of *c.* 1 litre capacity which are sunk into peat or similar substance beds. Water is applied regularly to the pots to maintain adequate growth. Plants are allowed to senesce naturally before lifting and storing the pots in a dry environment.

C.2.6.4 Disease assessment

The number of brown cysts is counted in the float which is extracted from each individual pot by Fenwick Can method. In the case of susceptible candidates on which there has been a large production of cysts, the total number of cysts may be estimated by counting only a proportion of the field e.g., ¼, provided the cysts are fairly evenly spread on the filter paper.

C.2.6.5 Submission of data

Trial results must be returned to the Trials Organiser by 15 April.

C.2.7 **Dry rot (*Fusarium coeruleum* and *sulphureum)***

C.2.7.1 Methodology

Susceptibility to dry rot (*Fusarium coeruleum* and *sulphureum*) is assessed by inoculating wounds made in the tuber and assessing the degree of rotting (A. E. W. Boyd. 1952. Dry rot disease of the potato. IV. Laboratory methods used in assessing variations in tuber susceptibility. *Annals of Applied Biology* **39:** 322-9). Wounds, *c.*5 mm deep and 4 mm in diameter, are made on opposite sides of each test tuber midway between rose and heel end for *F. sulphureum* (R.L. Wastie *et al.,* 1989. Comparative susceptibility of some potato cultivars to dry rot caused by *Fusarium sulphureum* and *F. solani* var. *coeruleum*.

Potato Research **32:** 49-55) and, for *F. coeruleum*, at rose and heel end of each test tuber (Boyd, 1952). A drop of 12.5 μl of a suspension of *c.* 8,000 spores ml^{-1} is injected into each wound to give *c.* 100 spores in a wound. Tubers are held in cardboard boxes lined with damp capillary matting at 12-15 ^{o}C until lesions are well developed on the susceptible control varieties. For *F. coeruleum,* tubers are inoculated in January and, for, *F.sulphureum,* in late January.

C.2.7.2 Plot size and trial design

There are 20 replicates, each of one tuber per variety laid out in a randomised block design.

C.2.7.3 Cultivation

At least 50 tubers are harvested from the main growing trial and stored in the dark in a frost-free store until testing.

C.2.7.4 Disease assessment

Tubers are cut through the wounds. The number of wounds with developing lesions and the exposed rotted tissue is scored as a proportion of total surface area in 6 categories as follows:

Class	I	II	III	IV	V	VI
% Surface area	0-1	1-10	10-25	25-50	50-75	75-100
Mid-point value	0.5	5	17.5	37.5	62.5	87.5

C.2.7.5 Submission of data

Trial results must be returned to the Trials Organiser by 15 April.

3 Control varieties and data submission

Control varieties and dates of submission are listed in Appendices 2 and 3 respectively.

Section D – Quality test procedures

1 Responsibilities

D.1.1 Growing Trial Operators will be responsible for carrying out the procedures for sample collection and testing described in this Section.

2 Procedures

D.2.1 Susceptibility to damage - external and internal

D.2.1.1 Methodology

Susceptibility to external and internal damage is assessed by a method similar to that described by P. A. Schipper (1971. *American Potato Journal* **48**: 71-81). A 100g bolt with a hemispherical head (20mm x 60mm) and fitted with a 40mm washer is dropped down a 44mm diameter PVC pipe on to the heel end of a tuber. The length of drop is 45cm for first earlies and 61cm for second earlies and maincrops. The point of damage is marked on each tuber. First early varieties are tested between October and December and second earlies and maincrops by end of January. Fifty tubers will be tested for each type of damage.

D.2.1.2 Plot size and trial design

Samples are harvested from specifically sown plots.

D.2.1.3 Cultivations

For each variety, two lots of 60 tubers in the size range 40-60 mm are carefully harvested by hand and stored at an ambient temperature in the dark for 2-3 weeks. Thereafter, one lot will be held between 4-6 ºC (assessment for external damage) and the second lot held between 9-11 ºC (assessment for internal damage) until applying damage treatment and thereafter at 8-12 ºC until assessment.

D.2.1.4 Damage assessment

Damage is assessed not less than 48 hours after the treatment. The number of tubers with visible splitting of the tuber skin at the point of impact is recorded for external damage assessment. For internal damage, the tubers are cut through the impact point and the depth of internal damage perpendicular to the tuber surface measured.

D.2.1.5 Submission of data

Trial results must be returned to the Trials Organiser by 15 April.

D.2.2 *Specific gravity* (additional)

A representative sample of 3.6kg tubers is collected from the produce of the growing trial and specific gravity is assessed using a potato hydrometer. Trial results must be submitted to Trials Organiser by 15 April.

D.2.3 Usage quality

All samples for quality usage testing are collected from the produce of the growing trial. Trial results must be submitted to Trials Organiser by 15 November.

D.2.3.1 Cooking

Within 10 days after harvest, six tubers are peeled and steamed for *c.* 1 hour until cooked then tasted for unusual or off-flavours. Scoring is on a 1-9 scale: 1 = severe; 9 = nil.

After-cooking blackening is assessed concurrently with the steaming tests. The tubers are scored for discolouration on a 1-9 scale, 1-2 hours after steaming: 1 = total discolouration; 9 = no discolouration.

D.2.3.2 *Crisping* (additional)

Within 10 days after harvest, ten slices of 1.6mm are cut from each of 6 tubers, rinsed in cold water and excess water removed. Slices are added to oil when the temperature reaches the fryer setting of 180^{o}C. Slices are fried for 3 minutes with the fryer switched off and with appropriate agitation to ensure that none of the slices stick together. The colour of crisps is assessed on a 1-9 scale of the EAPR crisp colour chart.

D.2.3.3 *French fry* (additional)

Harvested tubers are stored at 8-12^{0}C until testing in January. Twenty tubers are collected from the produce of the main growing trial. Using a McCain press, a single longitudinal chip, 9.5 mm square, is cut from each tuber. All 20 chips are fried for 90 seconds, starting when the oil temperature is 190^{o}C. The chips are agitated during frying. The colour and colour uniformity of each chip is scored on the 000-4 scale of the USDA Colour Standards for Frozen French-Fried Potatoes.

D.2.3.4 Baking (additional)

Material from the growing trial is used for a size comparison to establish suitability for the baking (jacket) potato market. The weight of tubers over 60mm for the marketable yield are compared to the weight of the total marketing yield. The figure is expressed as a percentage.

3 Control varieties and data submission

D.3.1 Control varieties and dates for submission of records are listed in Appendices 2 and 3 respectively.

Section E - 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).

Title of Supporting document:

United Kingdom Variety List Trials:

Trial Procedures for Official Examination of Value for Cultivation and Use (VCU)

Harvest 2024

Appendices

Potato

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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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.