Research Project Report

Independent Variety Trials 2017

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1. INTRODUCTION

In order to comply with both national and European Community legislation for the marketing of seed potatoes, all potato varieties must be placed on the official National List (NL) of a Member State. When this is achieved, a variety is automatically entered onto the Common Catalogue which is, in effect, an EC National List. Part of the NL testing involves assessing a new variety for Value for Cultivation and Use (VCU). In the UK, this testing is largely concentrated on assessing varietal performance for susceptibility to diseases, pests and some tuber quality characteristics considered to be of most importance in UK potato production. After a review of the Independent Variety Trials (IVT) programme, industry, through the Potato Council (now AHDB Potatoes), concluded that additional tests for some other diseases were also desirable in order to provide growers with the fullest information on the performance of new varieties before large scale production occurred. In addition, industry also concluded that potato varieties on the Common Catalogue which were being developed for GB production should also be tested to provide independent data on these varieties for GB growers. It was also decided that IVT tests would be conducted over 2 years and not 3 years as previously, and that industry alone would be responsible for conducting field growing trials to assess varietal performance with respect to yield and usage quality.

A review of the UK National List programme was concluded in 2004 and the various varietal characteristics were prioritised according to national importance and to industry. In consultation with industry stakeholders, it was also agreed that closer co-operation with IVT funded by AHDB Potatoes would be advantageous in minimising duplication of testing and in ensuring that the decision making process for the official listing of new varieties could utilise all available, good quality independent data such as that generated in IVT tests.

For National List purposes, the diseases and pests prioritised as being of national importance were foliage late blight, tuber late blight, blackleg (*Pectobacterium atrosepticum* syn. *Erwinia carotovora* var. *atroseptica*) and potato cyst nematode (*Globodera rostochiensis* pathotype Ro1). The characters agreed as being of less significance nationally but important to industry were powdery scab, common scab, dry rot - *Fusarium solani* var. *coeruleum*, dry rot - *F. sulphureum*, potato virus Yo*, potato leafroll virus*, potato cyst nematode (*Globodera pallida* pathotypes Pa2/3 and Pa1), external damage (splitting) and internal damage (bruising). In addition, unreplicated assessments of tuber yield, and external and internal tuber defects were to be made in order to comply with the requirements of the EU Directive 72/180/EEC and 02/8/EC. The consultation also agreed that varieties entered for IVT testing could be incorporated into NL tests.

* It was agreed to extend the NL programme from 2009 onwards to test for two additional potato viruses, these were virus A and virus Y^N.

The integration of the IVT test programme with that of the UK National List VCU test programme was achieved in 2005 by the consortium of Scottish Agricultural Science Agency (now Science and Advice for Scottish Agriculture (SASA)), SAC Commercial Ltd (SAC), Biomathematics & Statistics Scotland (BioSS) and Scottish Crop Research Institute (SCRI) (now James Hutton Limited (JHL)) which was awarded a 3 year contract to conduct the IVT programme. At that point, the tests conducted for IVT purposes were to determine varietal susceptibility to foliage late blight in the field, black dot, black scurf, silver scurf and skin spot. This contract was extended for a further 3 years starting 2008 and again for a further 3 years starting in 2011. A 1 year extension was given for 2014 to complete trialling of varieties that commenced IVT in 2013**.** An additional test to

determine susceptibility to potato mop top virus (spraing) was included in the programme from 2011. In 2012, the black scurf test was discontinued due to a high level of variability in the test data, resulting in inconsistent resistance ratings for this pathogen. As part of the programme, SASA have evaluated Common Catalogue varieties entered for IVT for all NL characters, except potato viruses (Y^o, Y^N, A and leafroll) and laboratory test for foliar late blight. A new 4 year contract was awarded to the consortium with the new programme commencing April 2015 with the IVT specific tests of field foliage blight, silver scurf and skin spot which are conducted at SASA and black dot and mop top (spraing) which are conducted at SAC. In 2015 the NL VCU test for foliage late blight was changed from a laboratory test to a field test. This change meant that the field foliage blight test was no longer an IVT specific test.

2. WORK UNDERTAKEN AND FINDINGS

In 2017, tests were conducted on 5 varieties which had completed UK NL tests, 3 varieties undergoing their 2nd year of UK NL testing, and 17 Common Catalogue varieties (Table 1a+b).

Pot tests for silver scurf and skin spot were conducted by SASA. A pot test for black dot and a field trial for mop top (spraing) were conducted by SAC. The Common Catalogue varieties were also tested by SASA for susceptibility to foliage late blight, tuber late blight, common scab, powdery scab, blackleg (*Pectobacterium atrosepticum*), dry rot (*Fusarium sulphureum* and *F. solani* var. *coeruleum*), potato cyst nematodes (pathotypes of *Globodera rostochiensis* and *G. pallida*), external damage (splitting) and internal damage (bruising). All tests were completed satisfactorily.

Susceptibility/resistance was rated on a 1-9 scale. Table 2 presents the ratings for varieties completing the test programme. Tables 3 summarises the results for varieties being tested in 2017. Provisional results from 1 year of testing in 2017 are shown in italic font. For NL VCU candidates the NL test results in Table 3 are shown in bold font as testing has been completed.

Table 1a. Varieties in IVT in 2017

UK National List

				stage of test 2017	
AFP	**Variety**	**Breeder/Agent**	**Maturity**	**NL**	**IVT**
4/831	Radebe (07.Z.104 A1)	Higgins Agriculture Ltd/Cygnet PB Ltd	M	completed	2
4/832	Elland (07.Z.120 A11)	Higgins Agriculture Ltd/Cygnet PB Ltd	EM	completed	2
4/833	Charlton (07.Z.129 A3)	Higgins Agriculture Ltd/Cygnet PB Ltd	EM	completed	2
4/834	Kingsman (05C040-006)	Cygnet PB Ltd	EM	completed	2
4/835	Alex (88.P.43 VAR)	JHI/MRS Ltd/Greenvale	M	completed	2
4/837	04.Z.22 A 15	JHI	LM	2	1
4/838	04.Z.35 A 15	JHI	EM	2	1
4/841	05.6556.1	Cullen Allen Ltd	EM	2	1

Table 1b. Varieties in IVT in 2017

Common Catalogue

				stage of test 2017	
AFP	**Variety**	**Breeder/Agent**	**Maturity**	**NL**	**IVT**
n/a	Carolus	Agrico/Agrico UK Ltd	M	2	2
n/a	Innovator	HZPC/HZPC UK Ltd	EM	2	2
n/a	Kelly	Germicopa SAS/Germicopa UK	M	2	2
n/a	Lady Valora	Meijer BV/Meijer Seed Potato Ltd	M	2	2
n/a	Sagitta	HZPC/HZPC UK Ltd	EM	2	2
n/a	Sunita	HZPC/HZPC UK Ltd	1E	1	1
n/a	Malou	Germicopa SAS/Germicopa UK	EM	1	1
n/a	Angelique	Germicopa SAS/Germicopa UK	1E	1	1
n/a	Gravity	IPM Potato Group Ltd	LM	1	1
n/a	Vanilla	IPM Potato Group Ltd	EM	1	1
n/a	Alibaba	IPM Potato Group Ltd	M		
n/a	Antarctica	IPM Potato Group Ltd	M	1	1
n/a	Jazzy	Meijer BV/Meijer Seed Potato Ltd	1E		
n/a	Rock	Meijer BV/Meijer Seed Potato Ltd	M	1	1
n/a	Lady Anna	Meijer BV/Meijer Seed Potato Ltd	M	1	1

Table 2. Summary of varietal ratings (1=low, 9=high) for resistance to diseases, pests and defects for varieties completing the IVT programme. Scores are based on over-years analysis of IVT 2005-2017 and NL from 1981 except for late blight* and PCN**.
* late blight: analysis covered only the period of testing with a 13_A2 genotype.
** PCN Ro1 and Pa2/3 are tested in year 1 and if resistance is found the test is repeated in year 2. Scores in the table are presented using a 1-9 scale as determined by the EU PCN Directive (2007/33/EC).

Results in individual test tables (tables 4-17) are based on the 2 test years and scores may vary slightly from data in this table which is based on an over years analysis.

	Radebe (07.Z.104 A1)	Elland (07.Z.120 A11)	Charlton (07.Z.129 A3)	Kingsman (05C040-006)	Alex (88.P.43 VAR)	Carolus	Innovator	Kelly	Lady Valora	Sagitta
Maturity	M	EM	EM	EM	M	M	EM	M	M	EM
Black dot	**8**	**6**	**6**	**7**	**8**	**6**	**9**	**8**	**5**	**4**
Silver scurf	**6**	**6**	**6**	**8**	**5**	**8**	**6**	**8**	**7**	**7**
Skin spot	**4**	**6**	**4**	**5**	**5**	**9**	**5**	**6**	**8**	**5**
Mop top	**8**	**7**	**8**	**8**	**7**	**7**	**8**	**8**	**7**	**8**
Foliage late blight (field)	**5**	**4**	**4**	**4**	**5**	**9**	**3**	**8**	**4**	**3**
Tuber late blight	**1**	**4**	**4**	**6**	**6**	**9**	**1**	**2**	**4**	**2**
Blackleg- *Pectobacterium atrosepticum*	**8**	**6**	**3**	**7**	**5**	**5**	**5**	**5**	**3**	**6**
Powdery scab	**7**	**4**	**6**	**4**	**8**	**4**	**7**	**2**	**5**	**4**
Common scab	**4**	**6**	**7**	**3**	**8**	**5**	**6**	**4**	**6**	**6**
Dry rot – *Fusarium coeruleum*	**7**	**6**	**6**	**8**	**7**	**7**	**8**	**8**	**6**	**7**
Dry rot – *Fusarium sulphureum*	**7**	**1**	**4**	**1**	**1**	**9**	**1**	**2**	**9**	**9**
PCN Ro-1	**6**	**3**	**2**	**9**	**4**	**2**	**2**	**9**	**8**	**8**
PCN Pa 2/3	**2**	**9**	**5**	**2**	**4**	**2**	**8**	**2**	**2**	**2**
External damage (splitting)	**8**	**8**	**7**	**8**	**7**	**6**	**5**	**7**	**7**	**7**
Internal damage (bruising)	**7**	**8**	**3**	**6**	**2**	**4**	**6**	**2**	**6**	**6**

Table 3. Summary of ratings (1=low, 9=high) for resistance to diseases, pests and defects for varieties completing one year of the IVT programme. Scores are based on over-years analysis of IVT 2005-2017 and NL from 1981 except for late blight* and PCN**.
* late blight: analysis covered only the period of testing with a 13_A2 genotype.
** PCN Ro1 and Pa2/3 are tested in year 1 and if resistance is found the test is repeated in year 2. Scores in the table are presented using a 1-9 scale as determined by the EU PCN Directive (2007/33/EC).

Results in individual test tables (tables 4-17) are based on 1 year only and scores may vary slightly from data in this table which is based on an over years analysis.

	04.Z.22 A 15	04.Z.35 A 15	05.6556.1	Alibaba	Angelique	Antarctica	Gravity	Jazzy	Lady Anna	Malou	Rock	Sunita	Vanilla
Maturity	LM	EM	EM	M	1E	M	LM	1E	M	EM	M	1E	EM
Black dot	*6*	*6*	*3*	*8*	*6*	*8*	*7*	*4*	*6*	*6*	*7*	*6*	*6*
Silver scurf	*7*	*5*	*6*	*8*	*4*	*9*	*6*	*7*	*8*	*8*	*6*	*7*	*7*
Skin spot	*4*	*7*	*6*	*6*	*4*	*6*	*7*	*6*	*9*	*3*	*5*	*5*	*4*
Mop top (spraing)	*8*	*7*	*7*	*7*	*6*	*6*	*6*	*8*	*8*	*6*	*4*	*5*	*3*
Foliage late blight (field)	**5**	**4**	**4**	*4*	*4*	*4*	*4*	*5*	*3*	*2*	*4*	*4*	*2*
Tuber late blight	**4**	**1**	**1**	*7*	*2*	*5*	*4*	*6*	*3*	*2*	*2*	*3*	*3*
Blackleg- *Pectobacterium atrosepticum*	**6**	**5**	**6**	*4*	*2*	*7*	*6*	*1*	*5*	*1*	*1*	*2*	*5*
Powdery scab	**6**	**6**	**5**	*6*	*6*	*5*	*6*	*6*	*5*	*6*	*6*	*5*	*5*
Common scab	**7**	**7**	**5**	*6*	*7*	*4*	*3*	*6*	*7*	*7*	*5*	*6*	*4*
Dry rot – *Fusarium coeruleum*	**5**	**7**	**8**	*6*	*8*	*8*	*8*	*6*	*3*	*8*	*5*	*4*	*7*
Dry rot – *Fusarium sulphureum*	**4**	**1**	**4**	*1*	*1*	*3*	*4*	*1*	*1*	*1*	*7*	*1*	*1*
PCN Ro-1	**4**	**2**	**8**	*3*	*8*	*1*	*2*	*2*	*9*	*2*	*8*	*8*	*1*
PCN Pa 2/3	**3**	**2**	**2**	*2*	*2*	*2*	*2*	*2*	*3*	*8*	*4*	*2*	*2*
External damage (splitting)	**7**	**6**	**6**	*6*	*1*	*7*	*5*	*6*	*6*	*5*	*5*	*6*	*6*
Internal damage (bruising)	**6**	**6**	**5**	*6*	*7*	*4*	*3*	*7*	*7*	*4*	*5*	*7*	*5*

Conclusions
In summary, the main findings (Resistant = 7 or more; Susceptible = 3 or less*) for the test varieties (with ratings in bold as appropriate) were as follows:
* For PCN Pa 2/3 and 1, a score of 4 or more has significant valuable resistance; a score of 3 or less is regarded as susceptible.

Radebe (07.Z.104 A1)
Resistant to: **black dot, mop top (spraing), blackleg, powdery scab, dry rots - *F. coeruleum* and *F. sulphureum*, external damage** and **internal damage.**
Susceptible to: **tuber late blight** and **PCN Pa 2/3 and 1**

Elland (07.Z.120 A11)
Resistant to: **mop top (spraing), PCN Pa 2/3 and 1, external damage** and **internal damage**
Susceptible to: **dry rot – *F. sulphureum*** and **PCN Ro1**

Charlton (07.Z.129 A3)
Resistant to: **mop top (spraing), common scab, PCN Pa 2/3 and 1** and **external damage**
Susceptible to: **blackleg, PCN Ro1,** and **internal damage**

Kingsman (05C040-006)
Resistant to: **black dot, silver scurf, mop top (spraing), blackleg, dry rot – *F. coeruleum*, PCN Ro1, and external damage**
Susceptible to: **common scab, dry rot – *F. sulphureum*** and **PCN Pa 2/3 and 1**

Alex (88.P.43 VAR)
Resistant to: **black dot, mop top (spraing), powdery scab, common scab, dry rot – *F. coeruleum*, PCN Pa 2/3 and 1** and **external damage**
Susceptible to: **dry rot – *F. sulphureum*** and **internal damage**

Carolus
Resistant to: **silver scurf, skin spot, mop top (spraing), foliage late blight, tuber late blight, and dry rots – *F. coeruleum*** and ***F. sulphureum***
Susceptible to: **PCN Ro 1** and **Pa 2/3 and 1**

Innovator
Resistant to: **black dot, mop top (spraing), powdery scab, dry rot – *F. coeruleum,* and PCN Pa 2/3 and 1**
Susceptible to: **foliage late blight, tuber late blight, dry rot - *F. sulphureum*,** and **PCN Ro1**

Kelly
Resistant to: **black dot, silver scurf, mop top (spraing), foliage late blight, dry rot – *F. coeruelum*, PCN Ro 1** and **external damage**
Susceptible to: **tuber late blight, powdery scab, dry rot – *F. sulphureum,* PCN Pa 2/3 and 1,** and **internal damage**

Lady Valora
Resistant to: **silver scurf, skin spot, mop top (spraing), dry rot - *F. sulphureum*, PCN Ro 1,** and **external damage**
Susceptible to: **blackleg** and **PCN Pa 2/3 and 1**

Sagitta
Resistant to: **silver scurf, mop top (spraing), dry rots – *F. coeruleum* and *F. sulphureum*, PCN Ro1, and external damage**
Susceptible to: **foliage late blight, tuber late blight,** and **PCN Pa 2/3 and 1**

04.Z.22 A 15
Resistant to*: silver scurf, mop top (spraing),* **common scab**, and **external damage**
Susceptible to: **PCN Pa 2/3 and 1**

04.Z.35 A 15
Resistant to: *skin spot, mop top (spraing),* **common scab,** and **dry rot– *F. coeruelum***
Susceptible to: **tuber late blight, *dry rot – F. sulphureum*, PCN Ro1** and **Pa 2/3 and 1**

05.6556.1
Resistant to: *mop top (spraing),* ***dry rot– F. coeruelum*,** and **PCN Ro1**
Susceptible to: *tuber late blight* and *PCN Pa 2/3 and 1*

Alibaba
Resistant to: *black dot, silver scurf, mop top (spraing),* and *tuber late blight*
Susceptible to: *dry rot - F. sulphureum,* and *PCN Ro 1* and *Pa 2/3 and 1*

Angelique
Resistant to: *common scab, dry rot– F. coeruelum, PCN Ro1,* and *internal damage*
Susceptible to: *tuber late blight, blackleg*, *dry rot – F. sulphureum, PCN Pa 2/3 and 1,* and *external damage*

Antarctica
Resistant to: *black dot, silver scurf, blackleg, dry rot – F. coeruleum,* and *external damage*
Susceptible to: *dry rot – F. sulphureum*, and *PCN Ro 1, and* Pa *2/3 and 1*

Gravity
Resistant to: *black dot, skin spot,* and *dry rot– F. coeruelum*
Susceptible to: *common scab, PCN Ro 1* and *Pa 2/3 and 1*, and *internal damage*

Jazzy
Resistant to: *silver scurf, mop top (spraing)* and *internal damage*
Susceptible to: *blackleg, dry rot – F. sulphureum*, and PCN Ro 1 and Pa 2/3 and 1

Lady Anna
Resistant to: *silver scurf, skin spot, mop top (spraing), common scab, PCN Ro1* and *internal damage*
Susceptible to: *foliage late blight, tuber late blight, dry rots – F. coeruleum* and *F. sulphureum,* and PCN *Pa 2/3 and 1*

Malou
Resistant to: *silver scurf, common scab, dry rot– F. coeruelum*, and PCN Pa 2/3 and 1
Susceptible to: *foliage late blight, tuber late blight, blackleg, dry rot – F. sulphureum*, and *PCN Ro 1*

Rock
Resistant to: black dot, *dry rot – F. sulphureum*, *PCN Ro 1* and *PCN Pa 2/3 and 1*
Susceptible to: *tuber late blight and blackleg*

Sunita
Resistant to: *silver scurf, PCN Ro1*, and *internal damage*
Susceptible to: *tuber late blight, blackleg*, *dry rot – F. sulphureum* and *PCN Pa 2/3 and 1*

Vanilla
Resistant to: *silver scurf* and *dry rot– F. coeruelum*,
Susceptible to: *mop top (spraing), foliage late blight, tuber late blight, dry rot – F. sulphureum, PCN Ro 1* and *Pa 2/3 and 1*

3. MATERIALS AND METHODS

3.1 Standard Varieties

The standard varieties used in 2016 were reviewed and retained in 2017. The varieties used in each IVT test* are listed below with, in brackets, their foliage maturity and the susceptibility rating as published in the NIAB TAG Potatoes 2016 book.

*For the mop top (spraing) test, the ratings are based on a 2016 review of the resistant and susceptible anchor varieties used in the over-years analysis.

Black dot:	Lady Christl [1E, 2], Pentland Squire [M, 3], Fianna [M, 5], Cara [M, 6], Saxon [2E, 7]
Silver scurf:	Lady Christl [1E, 2], Pentland Squire [M, 3], Romano [2E, 4], Fianna [M, 5], Saxon [2E, 5], Cara [M, 7]
Skin spot:	Pentland Squire [M, 2], King Edward [M, 3], Sante [M, 3], Saxon [2E, 6], Romano [2E, 7], Fianna [M, 8]
Potato mop top: virus (spraing)	Cara [M, 4], Nicola [M, 4], Valor [M, 3], Saturna [M, 3], Maris Piper [M, 8], Zahov [EM, 8]

Reference varieties for National List VCU tests are reviewed yearly and published online in the VCU procedures document which can be found at https://www.gov.uk/guidance/vcu-protocols-and-procedures-for-testing-agricultural crops#procedures---for-2017-harvest

3.2 Varieties in Trial

8 varieties were tested through the UK National List route and 15 varieties were tested through the Common Catalogue route. The varieties tested are listed in Tables 1a and 1b.

As a plant health precaution to prevent the introduction of non-indigenous bacterial pathogens, all seed potatoes from non-Scottish sources were tested for brown rot (*Ralstonia solanacearum),* ring rot (*Clavibacter michiganensis* subsp. *sepodonicus*), *Dickeya* spp. bacteria and Potato Spindle Tuber Viroid. Tests on all candidates were negative.

3. 3 IVT Test Methods

The test methods used were those agreed and set out in the standard protocols prepared for the 2017 programme. Details of this year's tests are provided below:

Skin spot, 2017
Test tubers were dipped for 0.5 min in a suspension of spores and mycelia (Carnegie & Cameron, 1983) and planted in pots containing a 1:1 mix of Bulrush compost and John Innes No 2 compost on 25 May. Pots were placed outdoors in peat beds and watered by drip irrigation into each pot. The layout was randomised block with 6 replications. A half dose of diquat dibromide was applied to plants in August to kill the haulm. The tubers were harvested into separate plastic boxes on 18 October and then stored at 5-8^{0}C until the last week in March. The % surface area affected by skin spot was recorded in 5 categories and a surface infection index calculated (Boyd, 1957).

Silver scurf, 2017
Petri dishes containing 2% malt extract agar were inoculated using two isolates of silver scurf which were grown for a minimum of 14 days, then macerated in distilled water. The suspension was added to Bulrush compost at a rate of 1L of suspension per 42L of soil and mixed in a small cement mixer. The test tubers were planted in pots containing the infested soil on 31 May and placed in a polytunnel; watering was by drip irrigation into each pot. The layout was a randomised block design with 6 replications. Haulms were allowed to senesce naturally.

Tubers were harvested on 24 October into separate plastic boxes and washed so visible symptoms could be observed, the tubers were then stored at 12-15^{o}C and high humidity until silver scurf lesions had developed sufficiently on the susceptible standard varieties. In late February, the % surface area affected by silver scurf on each tuber was assessed using 6 categories. A mean silver scurf index was calculated for each plot by multiplying the number of tubers in each category by the mid-point value and dividing the sum of these values by the total number of tubers assessed.

Black dot, 2017
Three isolates of *Colletotrichum coccodes* were cultured in Petri dishes on PDA agar. When the colonies had reached the edge of the dishes, the cultures were macerated using a liquidiser. The suspension was added to Bulrush compost at the rate of 1 Petri dish of *C. coccodes* per 8 kg compost in a cement mixer and mixed for 10 minutes. Test tubers were planted on 8 May, 2017 in 25 cm diameter pots filled with amended compost which were set in individual watering saucers and then placed in a polytunnel in a randomised block design with 6 replications. Pots were watered every 2 days so that

the compost was kept damp but not over-watered. Haulms were allowed to senesce naturally. Tubers were harvested on 27 September 2017 after symptoms of black dot had been seen on the daughter tubers of the susceptible reference varieties. The tubers were placed into paper bags and kept in a cold store. The % surface area affected by black dot was then assessed on 7 November, 2017.

Potato mop top virus (spraing), 2017

A plot in the Woodlands field at SAC Aberdeen previously contaminated with powdery scab / PMTV in 2009 was planted on the 17 May 2017 with varieties grown in triple tuber randomised blocks with 6 replicates. The plots were not irrigated during the season as it was sufficiently wet, particularly from late June onwards.

Haulm destruction took place on 9 August 2017 (flailing), 11 & 18 August 2017 (applications of desiccants). After harvest on the 31 October 2017 the tubers were placed in a cool store (c.18^{o}C) for 3 weeks before placed in a cold store at 4^{o}C. Tubers were assessed for visual symptoms of PMTV spraing after cutting on 16 January, 2018. All tubers from each of the 6 replicates were assessed individually. The results were expressed as the average percentage of the tubers showing symptoms.

3.4 NL Tests

These were conducted on Common Catalogue varieties in accordance with the document "United Kingdom National List Trials: Trials Procedures for the Official Examination of Value for Cultivation and Use (VCU) – Harvest 2017, Potato". The methods are summarised below:

Foliage late blight: test plants are grown in small field plots and exposed to spores of 13_A2 isolate of *P. infestans* from adjacent infected plants of a susceptible variety. Leaf area blighted is assessed on at least 3 occasions.

Tuber late blight: the rose-end of field-grown tubers is sprayed with a 13_A2 isolate of *P. infestans*. The number of tubers affected by late blight is counted after 10-14 days incubation.

Common Scab: test tubers are planted in pots in artificially infested compost kept dry during tuber initiation. Severity of common scab is assessed on daughter tubers.

Powdery scab: test tubers are planted in compost infected with scab peelings and kept wet during tuber initiation. Severity of powdery scab is assessed on daughter tubers.

Blackleg: test tubers are inoculated at the heel end with *Pectobacterium atrosepticum* and planted in an irrigated field trial. Incidence of blackleg is assessed 3 times during the growing season.

Dry rot (separate test for *Fusarium solani* var. *coeruleum* and *F. sulphureum*): test tubers are wounded and inoculated with a suspension of spores and incubated at 12-15^{0}C. The degree of internal rotting is assessed.

Potato Cyst Nematode (*Globodera* spp.): tubers are planted in pots in compost infected with a standard concentration of PCN eggs. Cyst multiplication on roots is assessed.

Damage, external (splitting) and internal (bruising): a standard force is applied to the heel end of field grown tubers. Tubers for the splitting test are stored at 4-6^{o}C and the incidence of splitting at the point of impact is recorded. Tubers for the bruising test are stored at 9-11^{o}C and the depth of damage at point of impact measured.

Statistical analysis

Most of the data was recorded as percentages and was angularly transformed before conducting an individual trial analysis of variance. For PCN and skin spot, log transformations were used.

Over-year trial means were calculated using REML from transformed trial means; for IVT the test years from 2005 (the year when the consortium took over the trialling) were used, giving 13 years for this report, and for NL tests, all years from 1981 were used where data was available. Late blight data is from 2008 when testing with the new isolate was introduced. This data was used to calculate the ratings presented in Tables 2 and 3. However, in the individual test reports, ratings presented are based on the analysis for the test years and have been presented to one decimal point to provide greater clarity. All ratings of 1-9 were derived by linear transformation (or according to a multiplication index for PCN) using varieties with known consistent susceptible and resistant reactions as fixed reference points.

4. RESULTS

IVT Tests

For each IVT test there is a summary of varieties in the 2 year of trials, focusing on their performance over both years. There is also a summary for varieties completing 1st year of trials in 2017, highlighting the performance of particular varieties. The 1-9 ratings listed for the varieties in the relevant test table are presented in bold font for varieties completing 2 years of trials; those scores in italic font are provisional scores after 1 year of testing. The names of the reference varieties are highlighted in bold font for each test.

Black dot (Table 4)

Single test tubers were planted in early May, 2017 in 25 cm diameter pots filled with amended compost. The pots were set in individual watering saucers in a polytunnel in a randomised block design with 6 replications. Pots were watered regularly so that the compost was kept damp but not over-watered. Haulms were allowed to senesce naturally and tubers harvested in late September.

Summary of 2016/2017 trial

Overall there was less black dot recorded in 2017 than 2016. There were some exceptions such as the reference variety Saxon, which is normally considered a variety of high resistance. Innovator was the most resistant variety in test scoring 7.0. No candidates were very susceptible with the lowest score of 3.7 achieved by Sagitta.

2017 trial

Antarctica and Alibaba were the most resistant of the first year candidates scoring 7.5 and 7.4 respectively. 05.6556.1 was the most susceptible in the test with a score of 2.9.

Table 4. Mean % (angular transformation) surface area affected by black dot

Variety	Test Year 2016	2017	1-9 rating
CARA	61.9	66.9	**3.7**
FIANNA	64.6	61.2	**3.8**
LADY CHRISTL	55.8	55.3	**4.5**
P SQUIRE	77.8	65.4	**3.0**
SAXON	52.7	72.6	**3.8**
RADEBE	39.8	30.7	**6.4**
ELLAND	59.0	42.7	**4.9**
CHARLTON	59.3	39.2	**5.1**
KINGSMAN	43.8	44.4	**5.6**
ALEX	46.9	33.5	**5.9**
CAROLUS	53.2	42.2	**5.2**
INNOVATOR	33.4	24.5	**7.0**
KELLY	43.6	32.5	**6.1**
LADY VALORA	56.4	53.1	**4.6**
SAGITTA	73.8	53.7	**3.7**
04.Z.22 A 15		47.7	*5.6*
04.Z.35 A 15		47.8	*5.6*
05.6556.1		66.0	*2.9*
ALIBABA		35.9	*7.4*
ANGELIQUE		48.3	*5.5*
ANTARCTICA		34.9	*7.5*
GRAVITY		40.2	*6.7*
JAZZY		59.3	*3.9*
LADY ANNA		48.8	*5.5*
MALOU		49.3	*5.4*
ROCK		42.0	*6.5*
SUNITA		44.9	*6.0*
VANILLA		47.9	*5.6*
LSD (P=0.05)	21.0	19.6	**1.5***

* For comparisons between varieties trialled in both years

Silver scurf (Table 5)

The trial was planted in late May and the plants grew well in the polytunnel. At harvest there were some visible silver scurf symptoms on the susceptible reference variety Lady Christl. Tubers were incubated in a humid controlled environment room until the assessment in late February

Summary of 2016/2017 trial

Overall there was more silver scurf recorded in 2017 than 2016 with Lady Christl remaining the most susceptible in the test. The most resistant varieties were Kingsman (7.6), Carolus (7.2) and Kelly (7.2). No candidates were susceptible, with the lowest score of 4.7 obtained by Alex.

2017 trial

The most resistant candidates were Antarctica (7.9), Malou (7.7), Alibaba (7.3) and Lady Anna (7.0). No candidates were susceptible. The lowest score obtained by the first year candidates was 4.1 (Angelique).

Table 5. Mean % (angular transformation) surface are affected by silver scurf

	Test Year		
Variety	**2016**	**2017**	**1-9 rating**
CARA	21.3	19.1	**7.0**
FIANNA	26.3	29.5	**5.8**
LADY CHRISTL	52.3	50.9	**2.0**
PENTLAND SQUIRE	30.0	26.5	**5.7**
ROMANO	25.7	26.5	**6.1**
SAXON	37.4	31.7	**4.7**
RADEBE	24.4	25.4	**6.3**
ELLAND	28.7	26.5	**5.8**
CHARLTON	24.6	26.0	**6.2**
KINGSMAN	13.9	18.4	**7.6**
ALEX	31.0	37.7	**4.7**
CAROLUS	17.9	20.0	**7.2**
INNOVATOR	27.6	22.3	**6.2**
KELLY	19.3	18.5	**7.2**
LADY VALORA	16.6	28.5	**6.6**
SAGITTA	23.0	24.6	**6.4**
04.Z.22 A 15		21.4	*6.6*
04.Z.35 A 15		35.4	*4.4*
05.6556.1		25.3	*6.0*
ALIBABA		17.3	*7.3*
ANGELIQUE		37.3	*4.1*
ANTARCTICA		13.2	*7.9*
GRAVITY		25.4	*6.0*
JAZZY		20.7	*6.7*
LADY ANNA		18.8	*7.0*
MALOU		14.8	*7.7*
ROCK		26.8	*5.8*
SUNITA		22.9	*6.4*
VANILLA		22.5	*6.5*
LSD (P=0.05)	5.6	6.1	**1.1***

* For comparisons between varieties trialled in both years

Skin spot (Table 6)
The trial was inoculated and planted in May. The plants grew well in the peat beds and tubers were harvested in October. To allow development of the skin spot in storage, tubers were kept in a controlled environment room until the assessment at the beginning of April.

Summary of 2016/2017 trial
Overall there was more skin spot recorded in 2017 than 2016. The reference variety Pentland Squire had considerably less skin spot than expected and tubers were sent for DNA fingerprinting to ensure the correct variety was tested. The results confirmed that the correct variety was used. The issue was raised with the statisticians at BioSS. It was agreed that the Pentland Squire result should remain in the analysis but that Pentland Squire should be replaced as the lower anchor for the scoring scale by the average of King Edward and Sante as a "2".
Two candidates were very resistant to skin spot scoring 9.0, these were Carolus and Lady Valora. None of the remaining candidates were susceptible.

2017 trial
Three candidate's demonstrated high resistance to skin spot all scoring 9.0, these were 04.Z.35 A 15, Gravity and Lady Anna. Only one first year candidate was susceptible, this was Malou which had a score of 3.4.

Table 6. Mean % (log transformation [log (skin spot% + 0.1) where log is log to base 10]) surface area affected by skin spot.

	Test Year		
Variety	**2016**	**2017**	**1-9 rating**
FIANNA	-0.6	-0.8	**9.0**
KING EDWARD	0.8	0.6	**2.3**
PENTLAND SQUIRE	0.9	-0.1	**4.0**
ROMANO	-0.1	-0.1	**7.0**
SANTE	0.8	0.7	**1.7**
SAXON	-0.2	-0.2	**7.8**
RADEBE	0.1	0.4	**4.9**
ELLAND	0.0	-0.4	**7.5**
CHARLTON	0.2	0.1	**5.6**
KINGSMAN	-0.2	0.0	**7.1**
ALEX	-0.2	0.1	**6.8**
CAROLUS	-0.7	-0.9	**9.0**
INNOVATOR	0.1	-0.1	**6.5**
KELLY	-0.3	-0.4	**8.6**
LADY VALORA	-0.7	-0.6	**9.0**
SAGITTA	0.1	-0.2	**6.5**
04.Z.22 A 15		0.1	*5.5*
04.Z.35 A 15		-0.4	*9.0*
05.6556.1		-0.3	*8.3*
ALIBABA		-0.2	*7.8*
ANGELIQUE		0.1	*5.8*
ANTARCTICA		-0.3	*8.1*
GRAVITY		-0.5	*9.0*
JAZZY		-0.3	*8.1*
LADY ANNA		-0.9	*9.0*
MALOU		0.4	*3.4*
ROCK		-0.0	*6.6*
SUNITA		0.0	*6.1*
VANILLA		0.1	*5.9*

LSD (P=0.05)	0.4	0.4	**2.8 ***

* For comparisons between varieties trialled in both years

Potato mop top virus (spraing) (Table 7)

A plot contaminated with powdery scab / PMTV in 2009 was planted at the beginning of June, with varieties grown in triple tuber randomised blocks with 6 replicates. The plots were not irrigated during the season. Normally, infection of PMTV occurs through invasion of root hairs by the powdery scab pathogen, which vectors the virus. Early season conditions were very dry but wet conditions returned in late June enabling release of the swimming spores of the powdery scab pathogen and subsequent infection by PMTV. This pattern of weather may have explained why spraing levels in tubers were lower than in 2016. After harvest in November, the tubers were placed in a cool store for 3 weeks before being placed in a cold store. Tubers were assessed for visual symptoms of PMTV spraing in January.

Summary of 2016/2017 trial

Less spraing was found in the reference varieties in 2017 compared to 2016, although overall there was more spraing in the candidate varieties in 2017. All candidates demonstrated resistance scoring between 7.1 and 8.7.

2017 trial

Three candidates demonstrated high resistance to spraing, scoring 7.9 (Jazzy and Lady Anna) and 7.7 (04.Z.22 A 15). Two candidates were susceptible, these were Vanilla (1.5) and Rock (2.4).

Table 7. Mean % (angular transformation) of tubers showing symptoms of potato mop top virus (spraing).

	Test Year		
Variety	**2016**	**2017**	**1-9 rating**
CARA	32.8	28.5	**2.7**
MARIS PIPER	4.4	2.3	**8.3**
NCOLA	7.3	3.5	**7.9**
SATURNA	37.4	30.6	**2.0**
VALOR	35.1	13.8	**4.0**
ZAHOV	10.4	2.4	**7.7**
RADEBE	0.0	8.7	**8.1**
ELLAND	7.3	8.4	**7.4**
CHARLTON	6.3	2.3	**8.1**
KINGSMAN	2.9	6.3	**8.1**
88.P.43 VAR	6.0	8.4	**7.5**
CAROLUS	3.1	15.1	**7.1**
INNOVATOR	6.0	3.1	**8.1**
KELLY	2.8	5.4	**8.2**
LADY VALORA	4.2	14.7	**7.1**
SAGITTA	0.0	2.4	**8.7**
04.Z.22 A 15		3.3	*7.7*
04.Z.35 A 15		9.4	*6.2*
05.6556.1		8.6	*6.4*
ALIBABA		7.9	*6.6*
ANGELIQUE		15.3	*4.7*
ANTARCTICA		11.0	*5.8*
GRAVITY		15.1	*4.8*

JAZZY		2.7	*7.9*
LADY ANNA		2.7	*7.9*
MALOU		11.1	*5.8*
ROCK		24.4	*2.4*
SUNITA		18.2	*4.0*
VANILLA		28.0	*1.5*
LSD (P=0.05)	11.4	12.0	**2.4***

NL Tests

For each NL test there is a summary of varieties entering the IVT programme through the common catalogue route. The first part of the summary is for varieties completing 2 years of trials, focusing on their performance over both years. The second part is for varieties completing 1st year of trials in 2017, highlighting the performance of particular varieties. The 1-9 ratings listed for the varieties in the relevant test table are presented in bold font for varieties completing 2 years of trials; those scores in italic font are provisional scores after 1 year of testing. The names of the reference varieties are highlighted in bold font for each test.

Foliage late blight (field) (Tables 8a+b)

The trial was planted in mid-May. The first assessment in 2017 was conducted 8 days after the infector plants were placed in the trial. The disease spread quickly after the second assessment with six assessments conducted in total.

Summary of 2016/2017 trial

Overall there was slightly more disease recorded in 2017 than 2016. Carolus showed a very high level of resistance (9.0), scoring higher than the resistant reference variety Sarpo Mira (8.0). Kelly also demonstrated good resistance scoring 7.7.

2017 trial

There were three first early candidates in 2017. All of these were susceptible to foliage late blight. No 2nd early/maincrop candidate demonstrated resistance. The most susceptible varieties in trial were Malou and Vanilla which both had a score of 1.6.

Table 8a. Mean % (angular transformation) Area under Disease Progress in foliage late blight field test in 2017 (1st early varieties)

	Test Year		
Variety	**2016**	**2017**	**1-9 rating**
HOME GUARD		49.3	*2.5*
ANGELIQUE		50.0	*2.3*
JAZZY		45.5	*3.1*
SUNITA		51.4	*2.1*
LSD (P=0.05)		5.6	

Table 8b. Mean % (angular transformation) Area under Disease Progress in foliage late blight field test in 2016 and 2017 (2nd early/maincrop varieties)

	Test Year		
Variety	**2016**	**2017**	**1-9 rating**
BINTJE	44.2	46.0	**3.0**
CARA	28.1	29.7	**5.7**
RUSSET BURBANK	34.7	47.4	**3.7**
SARPO MIRA	16.1	15.2	**8.0**
VALOR	29.1	32.0	**5.5**
CAROLUS	10.3	2.2	**9.0**
INNOVATOR	37.9	54.2	**2.8**
KELLY	18.9	15.9	**7.7**
LADY VALORA	34.8	49.4	**3.5**
SAGITTA	39.0	52.4	**2.9**
ALIBABA		45.5	*3.1*
ANTARCTICA		43.8	*3.4*
GRAVITY		41.2	*3.8*
LADY ANNA		50.4	*2.3*
MALOU		54.7	*1.6*
ROCK		43.5	*3.4*
VANILLA		54.5	*1.6*
LSD (P=0.05)	5.5	4.5	**1.9***

* For comparisons between varieties trialled in both years

Tuber late blight (Tables 9a+b)
Tubers were harvested from field plots on two occasions and sprayed with the late blight isolate. Tubers were stored for 12 days and then assessed for presence of late blight symptoms.

Summary of 2016/2017 trial
Overall there was more disease recorded in 2016 than 2017. Carolus was the only candidate to demonstrate resistance to tuber late blight scoring 7.9. The most susceptible candidate was Innovator with a score of 1.4.

2017 trial
In the first early trial, Jazzy demonstrated some resistance scoring 6.8. Angelique and Sunita were very susceptible, scoring 3.1 and 3.2 respectively. In the 2nd early/maincrop trial moderate resistance was observed in Alibaba scoring 6.5. Rock and Malou were both very susceptible scoring 1.3 and 1.7 respectively.

Table 9a. Mean % (angular transformation) tubers affected by late blight (1st Early varieties)

	Test Year		
Variety	**2016**	**2017**	**1-9 rating**
HOME GUARD		90.0	*2.0*
LULU		63.0	*6.0*
ANGELIQUE		82.4	*3.1*
JAZZY		57.4	*6.8*
SUNITA		82.2	*3.2*
LSD (P=0.05)		11.7	

Table 9b. Mean % (angular transformation) tubers affected by late blight (2nd early/maincrop varieties).

	Test Year		
Variety	**2016**	**2017**	**1-9 rating**
BINTJE	90.0	76.6	**2.0**
CARA	35.6	39.7	**6.0**
SARPO MIRA	75.5	73.5	**2.8**
VALOR	28.8	37.7	**6.4**
CAROLUS	23.4	8.5	**7.9**
INNOVATOR	90.0	90.0	**1.4**
KELLY	80.6	75.3	**2.5**
LADY VALORA	73.8	57.5	**3.5**
SAGITTA	86.8	77.5	**2.1**
ALIBABA		34.9	*6.5*
ANTARCTICA		48.9	*5.0*
GRAVITY		56.2	*4.2*
LADY ANNA		66.7	*3.1*
MALOU		83.5	*1.3*
ROCK		79.4	*1.7*
VANILLA		73.3	*2.4*
LSD (P=0.05)	10.6	10.3	**1.3***

* For comparisons between varieties trialled in both years

Blackleg (Table 10)
Reference varieties are tested at 2 sites each year as part of the NL programme. SASA and NIAB (the other UK NL test centre) both conduct a field trial. Common catalogue varieties are only tested at SASA. The 1-9 score for the reference varieties is from SASA and NIAB in 2016 and 2017. The 1-9 score for the candidate varieties are based on the 2016 and 2017 SASA trials only.

Tubers were inoculated just prior to planting the field trial in mid-May. Plants were assessed on three occasions for symptoms of blackleg.

Summary of 2016/2017 trial
There were lower levels of blackleg observed in 2017 compared to 2016. Sagitta was the most resistant candidate scoring 7.0, however it should be noted that there were differences between the blackleg levels observed in the two test years.

2017 trial
Antarctica was the only first year candidate to demonstrate resistance with a score of 7.5. Four candidates (Jazzy, Malou, Rock and Sunita) were very susceptible, all scoring 1.0. Angelique was also very susceptible with a score of 1.1.

Table 10. Mean % (angular transformation) plants affected by blackleg (*Pectobacterium atrosepticum)*

Variety	Test Year 2016 (SASA)	2016 (NIAB)	2017 (SASA)	2017 (NIAB)	1-9 rating^
AILSA	15.0	13.6	0.0	3.1	**8.0**
CONCURRENT	67.5	46.9	32.5	35.2	**3.0**
CULTRA	38.0	19.2	9.2	6.1	**6.6**
ESTIMA	30.7	56.4	22.6	42.5	**4.0**
MORENE	50.0	34.0	27.1	33.5	**4.2**
CAROLUS	33.9		25.0		**5.6**
INNOVATOR	32.6		23.0		**5.8**
KELLY	32.5		22.8		**5.8**
LADY VALORA	52.4		33.9		**3.7**
SAGITTA	35.0		3.1		**7.0**
ALIBABA			25.4		*3.6*
ANGELIQUE			41.8		*1.1*
ANTARCTICA			0.0		*7.5*
GRAVITY			10.6		*5.9*
JAZZY			48.8		*1.0*
LADY ANNA			15.0		*5.2*
MALOU			58.7		*1.0*
ROCK			75.0		*1.0*
SUNITA			46.0		*1.0*
VANILLA			17.5		*4.8*
LSD (P=0.05)	13.3	14.3	13.3	13.3	**2.8***

^NL trial is conducted at 2 sites (SASA and NIAB). Reference varieties have data from 2 sites in 2016 and 2017; 1-9 rating for candidate varieties have data from SASA only.
* For comparisons between varieties trialled in both years

Common scab (Table 11)
Reference varieties are tested at 2 sites each year as part of the NL programme. These sites are SASA and NIAB (the other UK NL test centre). Common catalogue varieties are only tested at SASA. The 1-9 score for the reference varieties is from SASA in 2016 and 2017 and NIAB in 2017. The 1-9 score for the candidate varieties are based on the 2016 and 2017 SASA trials only.

Tubers were planted in pots with infested soil in May and placed in a polytunnel. Irrigation was delivered by seep hosing. After harvest, tubers were assessed for surface area affected by common scab using a percentage scale.

Summary of 2016/2017 trial
There was slightly more common scab overall in 2017 than 2016. None of the candidates demonstrated resistance to common scab, with all seven candidates scoring between 5.2 and 3.7.

2017 trial
No candidate demonstrated high resistance to common scab with the best performing candidate Angelique scoring 6.0. Gravity was the most susceptible candidate scoring 3.0.

Table 11. Mean % (angular transformation) surface area affected by common scab

	Test Year				
Variety	**2016 (SASA)**	**2016 (NIAB)**	**2017 (SASA)**	**2017 (NIAB)**	**1-9 rating^**
DESIREE	52.9	-	52.9	39.5	**3.1**
ESTIMA	43.1	-	37.6	36.6	**4.8**
HOME GUARD	56.0	-	61.9	30.9	**2.9**
MARIS BARD	52.6	-	57.1	42.7	**2.7**
MARIS PEER	49.7	-	59.4	33.0	**3.3**
MARIS PIPER	53.3	-	53.4	56.3	**2.0**
PENTLAND CROWN	29.5	-	21.9	30.3	**7.0**
CAROLUS	40.4		47.6		**4.5**
INNOVATOR	47.8		37.9		**4.7**
KELLY	46.4		51.0		**3.7**
LADY VALORA	38.6		42.9		**5.1**
SAGITTA	39.4		41.7		**5.2**
ALIBABA			43.2		*5.2*
ANGELIQUE			38.3		*6.0*
ANTARCTICA			52.5		*3.5*
GRAVITY			55.5		*3.0*
JAZZY			43.5		*5.1*
LADY ANNA			40.3		*5.7*
MALOU			39.6		*5.8*
ROCK			46.1		*4.6*
SUNITA			41.3		*5.5*
VANILLA			49.1		*4.1*
LSD (P=0.05)	6.0		8.1	6.4	**2.4***

^NL trial is conducted at 2 sites (SASA and NIAB). Reference varieties have data from 1 site (SASA) in 2016 and 2 sites in 2017. This is because the NIAB 2016 data was excluded due to a lack of discrimination. Candidate varieties have data from SASA only.
* For comparisons between varieties trialled in both years

Powdery scab (Table 12)
Tubers were planted in pots with infested soil in May. Pots were placed in peat beds and watered by drip irrigation. After harvest, tubers were assessed for surface area affected by powdery scab using a percentage scale.

Summary of 2016/2017 trial
Overall there was less disease recorded in 2017 than 2016. Innovator was the most resistant candidate scoring 7.6. .

2017 trial
Six of the 10 candidates demonstrated some resistance to powdery scab scoring between 7.5 and 7.0; these candidates were Jazzy, Angelique, Alibaba, Gravity, Malou and Rock. No candidate was susceptible to powdery scab.

Table 12. Mean % (angular transformation) surface area affected by powdery scab

	Test Year		
Variety	**2016**	**2017**	**1-9 rating**
ACCENT	13.2	10.5	**7.4**
CARA	10.8	10.3	**7.6**
ESTIMA	43.9	36.2	**3.0**
PENTLAND CROWN	6.9	11.0	**7.9**
SANTE	8.1	8.1	**8.0**
CAROLUS	31.0	25.1	**4.9**
INNOVATOR	12.7	9.1	**7.6**
KELLY	45.2	36.1	**2.9**
LADY VALORA	22.7	15.1	**6.3**
SAGITTA	39.2	17.7	**4.8**
ALIBABA		12.5	*7.2*
ANGELIQUE		11.7	*7.3*
ANTARCTICA		16.5	*6.5*
GRAVITY		13.6	*7.0*
JAZZY		10.8	*7.5*
LADY ANNA		17.5	*6.3*
MALOU		13.9	*7.0*
ROCK		13.7	*7.0*
SUNITA		19.8	*5.9*
VANILLA		19.1	*6.0*
LSD (P=0.05)	5.5	5.6	**1.6***

* For comparisons between varieties trialled in both years

Dry rot (*Fusarium coeruleum)* (Table 13)
Tubers were inoculated in January with a concentration of *F. coeruleum* and stored in a controlled environment room for several weeks. Tubers were then assessed for symptoms of *F. coeruleum* by cutting and assessing rotted tissue using a percentage scale.

Summary of 2016/2017 trial
Overall there was more disease recorded in 2017 than 2016. No candidates were susceptible with scores ranging from 8.2 to 6.0. Innovator and Kelly were the best performing candidates scoring 8.1 and 7.7, respectively.

2017 trial
Lady Anna was the most susceptible candidate scoring 3.2. The majority demonstrated some resistance. Malou (8.1), Gravity (8.0) Angelique (7.9) and Antarctica (7.8) were the most resistant first year candidates.

Table 13. Mean % (angular transformation) internal area affected by *Fusarium coeruleum*

	Test Year		
Variety	**2016**	**2017**	**1-9 rating**
PENTLAND SQUIRE	49.9	30.0	**4.3**
SANTE	4.1	10.4	**8.0**
ESTIMA	8.0	17.0	**7.4**
CATRIONA	65.2	59.4	**1.7**
NADINE	19.6	24.1	**6.6**
CAROLUS	10.7	13.4	**7.4**
INNOVATOR	4.5	8.5	**8.1**
KELLY	5.8	14.2	**7.7**
LADY VALORA	27.9	21.0	**6.0**
SAGITTA	12.2	12.7	**7.4**
ALIBABA		26.7	*5.6*
ANGELIQUE		11.1	*7.9*
ANTARCTICA		11.6	*7.8*
GRAVITY		10.6	*8.0*
JAZZY		25.0	*5.9*
LADY ANNA		43.3	*3.2*
MALOU		9.7	*8.1*
ROCK		32.9	*4.7*
SUNITA		39.1	*3.8*
VANILLA		16.3	*7.1*
LSD (P=0.05)	8.2	7.4	**1.5***

* For comparisons between varieties trialled in both years

Dry rot (*Fusarium sulphureum)* (Table 14)

Tubers were inoculated in January with a concentration of *F. sulphureum* and stored in a controlled environment room for several weeks. Tubers were then assessed for symptoms of *F. sulphureum* by cutting and assessing rotted tissue using a percentage scale.

Summary of 2016/2017 trial

There was less disease recorded in 2017 compared to 2016. Three candidates demonstrated resistance; these were Saitta (8.3), Carolus (8.1) and Lady Valora (7.9). The four other candidates were susceptible scoring 1.0.

2017 trial

Rock was the only candidate that demonstrated resistance with a score of 7.8. Seven of the remaining nine candidates were very susceptible scoring 1.0.

Table 14. Mean % (angular transformation) internal area affected by *Fusarium sulphureum*

	Test Year		
Variety	**2016**	**2017**	**1-9 rating**
ATLANTIC	33.2	17.2	**3.5**
SAXON	23.5	11.3	**5.6**
NADINE	28.4	9.4	**5.2**
SANTE	9.4	7.4	**8.0**
MARIS PIPER	28.7	25.1	**3.0**
NECTAR	44.8	54.0	**1.0**
SYLVANA	22.3	10.0	**5.9**
CAROLUS	11.9	4.5	**8.1**
INNOVATOR	53.8	55.1	**1.0**
KELLY	52.6	30.6	**1.0**
LADY VALORA	12.6	4.9	**7.9**
SAGITTA	9.1	5.5	**8.3**
ALIBABA		46.6	*1.0*
ANGELIQUE		45.1	*1.0*
ANTARCTICA		28.1	*2.2*
GRAVITY		21.4	*4.1*
JAZZY		40.5	*1.0*
LADY ANNA		51.2	*1.0*
MALOU		35.1	*1.0*
ROCK		8.1	*7.8*
SUNITA		43.3	*1.0*
VANILLA		60.3	*1.0*
LSD (P=0.05)	8.4	10.7	**4.6***

* For comparisons between varieties trialled in both years

External damage (splitting) (Tables 15a+b)

Tubers were harvested from field plots and stored until the test in a controlled environment room. After damaging the tubers, they were stored for 5 days before assessing visible splitting of the skin at the point of impact.

Summary of 2016/2017 trial

Overall there was a lower level of splitting recorded in 2017; this can be influenced by environmental factors. There was a large difference in performance between years for reference variety Maris Piper. The results were checked and trial tubers were sent for DNA fingerprinting to ensure the correct variety had been tested. The testing confirmed the variety was correct. The results were discussed with BioSS and it was agreed that the result should remain in the analysis.
Lady Valora (6.8) and Kelly (6.6) were the most resistant candidates.

2017 trial

In the 1st early trial, Jazzy and Sunita both scored 6.4 while the other candidate Angelique was very susceptible scoring 1.0. The seven 2nd early/maincrop varieties all scored between 5.1 and 6.4. .

Table 15a. Mean % tubers affected by splitting after applying standard force (1st early varieties)

Variety	Test Year 2016	2017	1-9 rating
ULSTER SCEPTRE		40.0	*2.0*
HOME GUARD		3.3	*6.1*
ANGELIQUE		91.9	*1.0*
JAZZY		0.0	*6.4*
SUNITA		0.0	*6.4*

Table 15b. Mean % tubers affected by splitting after applying standard force (2nd early/maincrop varieties)

Variety	Test Year 2016	2017	1-9 rating
MARIS PEER	8.0	6.0	**6.2**
MARIS PIPER	44.0	3.9	**4.8**
RECORD	14.0	4.0	**6.0**
RED CRAIGS ROYAL	72.0	30.0	**2.5**
RUSSET BURBANK	46.0	32.0	**3.5**
CAROLUS	24.0	8.0	**5.4**
INNOVATOR	36.0	14.0	**4.7**
KELLY	2.0	2.0	**6.6**
LADY VALORA	0.0	0.0	**6.8**
SAGITTA	8.0	0.0	**6.4**
ALIBABA		2.0	*6.2*
ANTARCTICA		0.0	*6.4*
GRAVITY		12.0	*5.1*
LADY ANNA		10.0	*5.3*
MALOU		12.0	*5.1*
ROCK		12.0	*5.1*
VANILLA		5.9	*5.8*
LSD (P=0.05)			**1.8***

* For comparisons between varieties trialled in both years

Internal damage (bruising) (Tables 16a+b)

Tubers were harvested from field plots and stored until the test in a controlled environment room. After damaging the tubers, they were stored for 5 days before measuring the depth of internal damage at the point of impact.

Summary of 2016/2017 trial

There was less bruising recorded in 2017. None of the candidates demonstrated high resistance to internal damage. One of the candidates, Kelly was susceptible with a score of 2.9.

2017 trial

In the 1st early trial all three candidates performed similarly scoring between 5.5 and 5.0. Lady Anna (7.6) was the most resistant of the 2nd early/maincrop candidates. None were very susceptible.

Table 16a. Mean depth (mm) of bruise at point of impact of standard (1st early varieties)

	Test Year		
Variety	**2016**	**2017**	**1-9 rating**
ULSTER SCEPTRE		6.8	*1.8*
HOME GUARD		3.2	*5.4*
ANGELIQUE		3.6	*5.0*
JAZZY		3.1	*5.5*
SUNITA		3.2	*5.4*

Table 16b. Mean depth (mm) of bruise at point of impact of standard force (2nd early/maincrop varieties)

Variety	Test Year 2016	2017	1-9 rating
MARIS PEER	5.9	4.1	**5.0**
MARIS PIPER	4.7	2.6	**6.0**
RECORD	4.8	3.4	**5.7**
RED CRAIGS ROYAL	7.1	2.7	**5.1**
RUSSET BURBANK	8.3	4.6	**4.0**
CAROLUS	5.9	3.9	**5.1**
INNOVATOR	4.2	2.8	**6.1**
KELLY	12.2	3.7	**2.9**
LADY VALORA	4.7	1.4	**6.4**
SAGITTA	5.0	1.5	**6.3**
ALIBABA		1.9	*6.6*
ANTARCTICA		3.4	*5.2*
GRAVITY		4.8	*3.8*
LADY ANNA		0.9	*7.6*
MALOU		3.5	*5.1*
ROCK		3.2	*5.4*
VANILLA		2.7	*5.9*
LSD (P=0.05)			**2.0***

* For comparisons between varieties trialled in both years

Potato Cyst Nematode (Table 17)

High level resistance to PCN (*G. rostochiensis* Ro1) is normally conferred by the major gene H1 and results in minimal multiplication of cysts on the potato. Varieties completing trials that expressed this type of resistance to Ro1 were Kelly, Lady Valora and Sagitta. Candidates in first year trials that demonstrated this resistance were Angelique, Lady Anna, Rock and Sunita.

Innovator which has completed trials, and the first year candidate Malou showed high resistance to *G. pallida.*

Table 17. Multiplication of cysts of 3 pathotypes of potato cyst nematode (*Globodera rostochiensis* pathotype 1; *G. pallida* pathotypes 2/3 and 1) on test varieties, expressed as 1-9 rating as determined by the EU PCN Directive (2007/33/EC).

VARIETY	Ro1	Pa 2/3	Pa1
DESIREE	**1(S)** †	**1(S)**	**1 (S)**
ESTIMA	**2 (S)**	*	*
MARIS PIPER	**8 (R)**	**2 (S)**	**2 (S)**
12380	**8 (R)**	**7**	**7**
VANTAGE	**5**	**5**	**6**
MORAG	**5**	**3**	**3**
VALES EVEREST	*	**6**	**9 (R)**
INNOVATOR	*	**8 (R)**	**9 (R)**
CAROLUS	**2**	**2**	*
INNOVATOR	**2**	**8**	**9**
KELLY	**9**	**2**	*
LADY VALORA	**8**	**2**	*
SAGITTA	**8**	**2**	*
ALIBABA	*3*	*2*	*
ANGELIQUE	*8*	*2*	*
ANTARCTICA	*1*	*2*	*
GRAVITY	*2*	*2*	*
JAZZY	*2*	*2*	*
LADY ANNA	*9*	*3*	*
MALOU	*2*	*8*	*
ROCK	*8*	*4*	*
SUNITA	*8*	*2*	*
VANILLA	*1*	*1*	*

† S denotes fully susceptible reference varieties and R denotes fully resistant reference varieties
* not tested

5. DISCUSSION

The full range of disease tests was completed on time with reasonable disease development in most tests. In some tests e.g. silver scurf, skin spot and common scab, disease severity was greater in 2017 than in 2016, whereas the incidence of black dot, mop top (spraing) and powdery scab was less in 2017 than 2016. Variations like this may be a result of differing disease pressures and environmental conditions in the test year; therefore caution is required when considering ratings particularly for those with only one year of the test.

In 2015 the field foliage late blight test became a NL VCU test replacing the previous laboratory test. The methodology remained the same as when the trial was an IVT specific test. In the reporting years, the variety Carolus proved to have very high resistance to foliage late blight. In both 2016 and 2017, the variety had less foliage blight recorded than the resistant reference variety Sarpo Mira. Carolus also had high resistance to tuber late blight.

In the NL and IVT testing programmes, the resistance of a candidate variety to a range of diseases is evaluated in a series of standardised tests which each include a set of standard reference varieties whose reactions are known. For each disease in this report, the resistance rating of a candidate variety is determined by comparing the amount of disease developing on the candidate variety with that on the standard varieties over the two years of testing. The process of calculating variety scores is subject to regular review. As part of a review of NL decision making, statistical advice was that over-year means should be calculated from data for as many years as possible rather than two test years. This proposal has been adopted for NL analysis using data since 1981 and has been applied to IVT data for the last 13 years. This has meant that small changes in some of the historic ratings ascribed to a variety have occurred, sometimes exacerbated by the process of rounding up or down to a whole number. For example, a variety scoring 3.6 for a character is recorded as 4, the same as a variety scoring 4.4. Small shifts in the calculations may move these values up or down. **Users of this data should bear in mind that the final rating of a variety should be treated as a broad guide as to how a variety might perform in practice rather being an absolute value.**

In this report, the 1-9 scores presented in Tables 2a, 2b and 3 are from the over years analysis as recommended by the statisticians at BioSS. These scores for varieties completing trials are used for publication on the AHDB Potatoes Variety Database. The 2 year tables (tables 4-16) show the performance over the test years and the 1-9 score here can vary slightly from those in Tables 2a, 2b and 3.

Disease resistance ratings are recorded on a 1 to 9 scale where 1 is highly susceptible and 9 very resistant. Thus the higher the value, the more resistant a variety is to a disease. Typically, varieties with a score of 1, 2 or 3 would be considered highly susceptible, those with a score 4 or 5 considered susceptible, those with a score 6 or 7 moderately resistant and those with scores 8 or 9 highly resistant. **A high resistance score should not be taken as indicating that a disease will be absent but that there is less risk of the disease developing on these varieties**. With most other diseases and faults, all varieties can be affected to a greater or lesser extent. In consequence, the need for other control measures such as fungicide application should be evaluated, based on other factors such as the level of inoculum likely to be present and whether environmental conditions favour the pathogen.

10 varieties completed IVT in 2017. These were Radebe, Elland, Charlton, Kingsman, Alex, Carolus, Innovator, Kelly, Lady Valora, and Sagitta. An overview of strengths and weaknesses for these varieties is listed on pages 10 to 12 of this report. Scores for these varieties have been published on the AHDB Potatoes Variety Database. This database which was launched online in 2007 as the British Potato Variety Database has proved to be a useful tool for the publication of data from the NL and IVT programme. It allows the publication of data once results have been finalised which is usually by the end of July each year. The site is easy to use and has a search facility and the ability to compare two varieties on one screen.

6. REFERENCES

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