



Research Project Report

Independent Variety Trials

2018

Ref: 11120013

Reporting Period: April 2018 - July 2019

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Report No. 2019/12



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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 the AHDB-funded IVT programme 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 Y^{o*}, 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. This report summarises all the testing conducted over the 2017-2018 season.

2. WORK UNDERTAKEN AND FINDINGS

In 2018, tests were conducted on 3 varieties which had completed UK NL tests and 10 Common Catalogue varieties (Tables 1a+b). These varieties were all in the 2nd year of the IVT programme. In 2018 no 1st year varieties were tested.

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 but data for the 2018 mop top (spraing) and common scab tests were excluded from the analysis.

Susceptibility/resistance was rated on a 1-9 scale. Table 2 presents the ratings for varieties completing the test programme.

Table 1a. Varieties in IVT in 2018

UK National List route

AFP	Variety	Breeder/Agent	Maturity	stage of test 2018	
				NL	IVT
4/837	Andeana (04.Z.22 A 15)	JHI	LM	completed	2
4/838	Inca Rosa (04.Z.35 A 15)	JHI	EM	completed	2
4/841	Harry (05.6556.1)	Cullen Allen Ltd	EM	completed	2

Table 1b. Varieties in IVT in 2018**Common Catalogue route**

AFP	Variety	Breeder/Agent	Maturity	stage of test 2018	
				NL	IVT
n/a	Sunita	HZPC/HZPC UK Ltd	1E	2	2
n/a	Malou	Germicopa SAS/Germicopa UK	EM	2	2
n/a	Angelique	Germicopa SAS/Germicopa UK	1E	2	2
n/a	Gravity	IPM Potato Group Ltd	LM	2	2
n/a	Vanilla	IPM Potato Group Ltd	EM	2	2
n/a	Alibaba	IPM Potato Group Ltd	M	2	2
n/a	Antarctica	IPM Potato Group Ltd	M	2	2
n/a	Jazzy	Meijer BV/Meijer Seed Potato Ltd	1E	2	2
n/a	Rock	Meijer BV/Meijer Seed Potato Ltd	M	2	2
n/a	Lady Anna	Meijer BV/Meijer Seed Potato Ltd	M	2	2

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 2005-2018 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 3-16) are based on the specific test years and scores may vary slightly from data in this table which is based on an over years analysis.

	Andeana (04.Z.22 A 15)	Inca Rosa (04.Z.35 A 15)	Harry (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	7	5	4	7	3	7	6	4	5	5	5	4	4
Silver scurf	7	4	6	7	4	8	7	7	7	8	6	7	7
Skin spot	5	7	4	5	4	7	7	6	9	3	4	4	5
Mop top (spraing)	8 [^]	7 [^]	7 [^]	7 [^]	6 [^]	7 [^]	6 [^]	8 [^]	8 [^]	7 [^]	4 [^]	5 [^]	3 [^]
Foliage late blight (field)	5	4	4	4	3	4	4	4	3	2	4	3	3
Tuber late blight	4	1	1	6	3	5	5	5	3	2	3	3	3
Blackleg- <i>Pectobacterium atrosepticum</i>	6	5	6	4	3	7	6	2	4	1	1	3	4
Powdery scab	6	6	5	6	6	5	6	6	5	5	6	5	5
Common scab	7	7	5	6 [^]	7 [^]	4 [^]	3 [^]	6 [^]	7 [^]	7 [^]	5 [^]	6 [^]	4 [^]
Dry rot – <i>Fusarium coeruleum</i>	5	7	8	6	8	8	7	6	4	8	5	4	7
Dry rot – <i>Fusarium sulphureum</i>	4	1	4	1	1	4	3	1	1	1	8	1	1
PCN Ro-1	4	2	8	3	8	1	2	2	9	2	9	9	2
PCN Pa 2/3	3	1	2	2	1	1	2	2	2	8	3	2	1
External damage (splitting)	7	6	6	6	1	6	5	6	5	4	5	6	6
Internal damage (bruising)	6	6	5	6	6	5	5	7	6	3	5	7	6

[^] score is based on one year of testing only

3. 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.

It should be noted that the mop top (spraing) score for all varieties is based on one test year only (2017). For common catalogue varieties, the common scab score is based on one test year only (2017).

Varieties from NL route –

Andeana (04.Z.22 A 15)

Resistant to: **black dot, silver scurf, mop top (spraing), common scab, and external damage**

Susceptible to: **PCN Pa 2/3 and 1**

Inca Rosa (04.Z.35 A 15)

Resistant to: **skin spot, mop top (spraing), common scab, and dry rot – *F. coeruleum***

Susceptible to: **tuber late blight, dry rot – *F. sulphureum*, PCN Ro1 and Pa 2/3 and 1**

Harry (05.6556.1)

Resistant to: **mop top (spraing), dry rot – *F. coeruleum*, and PCN Ro1**

Susceptible to: **tuber late blight and PCN Pa 2/3 and 1**

Varieties from common catalogue route -

Alibaba

Resistant to: **black dot, silver scurf, and mop top (spraing)**

Susceptible to: **dry rot - *F. sulphureum*, PCN Ro 1 and Pa 2/3 and 1**

Angelique

Resistant to: **common scab, dry rot – *F. coeruleum*, and PCN Ro1**

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

Antarctica

Resistant to: **black dot, silver scurf, skin spot, mop top (spraing), blackleg, and dry rot – *F. coeruleum***

Susceptible to: **PCN Ro 1 and Pa 2/3 and 1**

Gravity

Resistant to: **silver scurf, skin spot, and dry rot – *F. coeruleum***

Susceptible to: **common scab, dry rot – *F. sulphureum*, PCN Ro 1 and Pa 2/3 and 1**

Jazzy

Resistant to: **silver scurf, mop top (spraing) and internal damage**

Susceptible to: **blackleg, dry rot – *F. sulphureum*, PCN Ro 1 and Pa 2/3 and 1**

Lady Anna

Resistant to: **silver scurf, skin spot, mop top (spraing), common scab, and PCN Ro1**

Susceptible to: **foliage late blight, tuber late blight, dry rot – *F. sulphureum*, and PCN Pa 2/3 and 1**

Malou

Resistant to: **silver scurf, mop top (spraing), common scab, dry rot – *F. coeruleum*, and PCN Pa 2/3 and 1**

Susceptible to: **skin spot, foliage late blight, tuber late blight, blackleg, dry rot – *F. sulphureum*, and PCN Ro 1, and internal damage**

Rock

Resistant to: **dry rot – *F. sulphureum* and PCN Ro 1**

Susceptible to: **tuber late blight and blackleg, and PCN Pa 2/3 and 1**

Sunita

Resistant to: **silver scurf, PCN Ro1, and internal damage**

Susceptible to: **foliage late blight, tuber late blight, blackleg, dry rot – *F. sulphureum* and PCN Pa 2/3 and 1**

Vanilla

Resistant to: **silver scurf and dry rot – *F. coeruleum***

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

4. MATERIALS AND METHODS

4.1. Standard Varieties

The standard varieties used in 2017 were reviewed and retained in 2018. 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: Cara [M, 4], Nicola [M, 4], Valor [M, 3], Saturna [M, 3], virus (spraing) Maris Piper [M, 8], Zahov [EM, 8]

Protocols for the four IVT specific tests above can be found in Appendix 1.

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-2018-harvest>

4.2. Varieties in Trial

Three varieties were tested through the UK National List route and 10 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. *sepedonicus*), *Dickeya* spp. bacteria and Potato Spindle Tuber Viroid. Tests on all candidates were negative.

4.3. IVT Test Methods

The test methods used were those agreed and set out in the standard protocols prepared for the 2018 programme. Details of this year's tests are provided below:

Skin spot, 2018

Test tubers were dipped for 0.5 minutes 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 27 April. Pots were placed outdoors in peat beds and watered by drip irrigation into each pot. The layout was a randomised block with 6 replications. A half dose of diquat dibromide was applied to plants in mid-August to kill the haulm. The tubers were harvested into separate plastic boxes on 25 October and then stored at 5-8°C until early April. The % surface area affected by skin spot was recorded in 5 categories and a surface infection index calculated (Boyd, 1957).

Silver scurf, 2018

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 24 April 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°C with high humidity until silver scurf lesions had developed sufficiently on the susceptible standard varieties. In late January, 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, 2018

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 13th May, 2018 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 23 September 2018 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 December, 2018.

Potato mop top virus (spraing), 2018

A plot in the Woodlands field at SRUC Aberdeen previously contaminated with powdery scab / PMTV in 2009 was planted on the 8th May 2018 with varieties grown in triple tuber randomised blocks with 6 replicates. The plots were not irrigated during the season as it was sufficiently wet.

Haulm destruction took place on 30 August 2018 (applications of desiccant). After harvest on the 24 October 2018 the tubers were placed in an ambient store (c.18°C) for 3 weeks before placed in a cold store at 4°C. Tubers were assessed for visual symptoms of PMTV spraing after cutting on 18 December, 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.

4.4. 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°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°C and the incidence of splitting at the point of impact is recorded. Tubers for the bruising test are stored at 9-11°C and the depth of damage at point of impact measured.

4.5. 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 14 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 Table 2. 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.

5. RESULTS

5.1. IVT Tests

For each IVT test there is a summary of varieties in the 2 years of trials, focusing on their performance over both years. The 1-9 ratings listed for the varieties in the relevant test table are presented in bold font. The names of the reference varieties are highlighted in bold font for each test.

Black dot (Table 3)

Single test tubers were planted in mid-May 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 2017/2018 trial

Overall there was less black dot recorded in 2018 than 2017. There were some exceptions such as Angelique, Rock, Sunita and Vanilla. Alibaba was the most resistant scoring 7.1. Angelique scored 3.0 which was the least resistant of all candidates in the test.

Table 3. Mean % (angular transformation) surface area affected by black dot

Variety	Test Year		1-9 rating
	2017	2018	
CARA	66.9	29.8	4.7
FIANNA	61.2	39.7	4.4
LADY CHRISTL	55.3	43.9	4.5
P SQUIRE	65.4	51.8	3.0
SAXON	72.6	40.2	3.4
ANDEANA	47.7	23.7	6.8
INCA ROSA	47.8	49.8	4.6
HARRY	66.0	45.5	3.5
ALIBABA	35.9	31.6	7.1
ANGELIQUE	48.3	69.0	3.0
ANTARCTICA	34.9	35.5	6.9
GRAVITY	40.2	36.5	6.4
JAZZY	59.3	42.0	4.3
LADY ANNA	48.8	44.1	5.0
MALOU	49.3	41.2	5.2
ROCK	42.0	52.1	4.9
SUNITA	44.9	59.2	4.1
VANILLA	47.9	63.3	3.5
LSD (P=0.05)	19.6	16.1	4.1*

* For comparisons between varieties trialled in both years

Silver scurf (Table 4)

The trial was planted in late April 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 at the end of January.

Summary of 2017/2018 trial

Overall there was more silver scurf recorded in 2018 than 2017. As in previous years, the reference variety Lady Christl was the most susceptible in test with a score of 2.0. The most resistant varieties were Antarctica and Malou scoring 6.9 and 6.6 respectively. The least resistant varieties were Inca Rosa and Angelique which both scored 4.0

Table 4. Mean % (angular transformation) surface are affected by silver scurf

Variety	Test Year		1-9 rating
	2017	2018	
CARA	19.1	12.0	7.0
FIANNA	29.5	27.8	5.3
LADY CHRISTL	50.9	57.3	2.0
PENTLAND SQUIRE	26.5	39.9	4.7
ROMANO	26.5	23.7	5.8
SAXON	31.7	42.8	4.2
ANDEANA	21.4	19.6	6.4
INCA ROSA	35.4	42.4	4.0
HARRY	25.3	25.5	5.7
ALIBABA	17.3	22.4	6.4
ANGELIQUE	37.3	40.0	4.0
ANTARCTICA	13.2	19.0	6.9
GRAVITY	25.4	23.4	5.8
JAZZY	20.7	24.8	6.1
LADY ANNA	18.8	22.5	6.3
MALOU	14.8	22.3	6.6
ROCK	26.8	31.6	5.2
SUNITA	22.9	19.5	6.3
VANILLA	22.5	20.0	6.3
LSD (P=0.05)	6.1	6.0	1.0*

* For comparisons between varieties trialled in both years

Skin spot (Table 5)

The trial was inoculated and planted in late April. The plants grew well in the peat beds and tubers were harvested in late October. To allow development of the skin spot in storage, tubers were kept in a controlled environment room until the assessment in early April.

Summary of 2017/2018 trial

Overall there was more skin spot recorded in 2018 than 2017. As reported last year the reference variety Pentland Squire had considerably less skin spot than expected in 2017 and tubers were sent for DNA fingerprinting to ensure the correct variety was tested. The results confirmed that the correct variety was used. In 2018, Pentland Squire performed as expected with similar levels of skin spot as the other susceptible reference variety King Edward.

Lady Anna was the most resistant candidate scoring 9.0 which was the same as the resistant reference variety Fianna. Four other candidates demonstrated good resistance to skin spot, these were Antarctica (8.6), Inca Rosa (8.5), Gravity (8.3) and Jazzy (7.9). Malou was the only susceptible candidate in the test scoring 2.6.

Table 5. Mean % (log transformation [$\log(\text{skin spot}\% + 0.1)$ where log is log to base 10]) surface area affected by skin spot.

Variety	Test Year		1-9 rating
	2017	2018	
FIANNA	-0.8	-0.6	9.0
KING EDWARD	0.6	0.6	2.1
PENTLAND SQUIRE	-0.1	0.6	4.3
ROMANO	-0.1	-0.2	7.0
SANTE	0.7	0.5	1.9
SAXON	-0.2	0.3	5.5
ANDEANA	0.1	0.1	5.4
INCA ROSA	-0.4	-0.3	8.5
HARRY	-0.3	0.6	5.0
ALIBABA	-0.2	0.3	5.9
ANGELIQUE	0.1	0.2	5.3
ANTARCTICA	-0.3	-0.5	8.6
GRAVITY	-0.5	-0.1	8.3
JAZZY	-0.3	-0.3	7.9
LADY ANNA	-0.9	-0.7	9.0
MALOU	0.4	0.6	2.6
ROCK	-0.0	0.3	5.1
SUNITA	0.0	0.4	4.5
VANILLA	0.1	-0.2	6.6
LSD (P=0.05)	0.4	0.4	3.3 *

* For comparisons between varieties trialled in both years

Potato mop top virus (spraing) (Table 6)

A plot contaminated with powdery scab / PMTV in 2009 was planted at the beginning of May with varieties grown in triple tuber randomised blocks with 6 replicates. The plots were not irrigated during the season as it was sufficiently wet. After harvest in late October, the tubers were placed in an ambient store for 3 weeks before being placed in a cold store. Tubers were assessed for visual symptoms of PMTV spraing in December.

Due to low levels of disease in 2018 the data was excluded from the analysis. The warm weather was suggested as a factor in the low disease levels.

Summary of 2017 trial

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

Table 6. Mean % (angular transformation) of tubers showing symptoms of potato mop top virus (spraing).

Variety	Test Year		1-9 rating
	2017	2018	
CARA	28.5		1.4
MARIS PIPER	2.3		8.0
NICOLA	3.5		7.7
SATURNA	30.6		1.0
VALOR	13.8		5.1
ZAHOV	2.4		8.0
ANDEANA	3.3		7.7
INCA ROSA	9.4		6.2
HARRY	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)	12.0		*

5.2. NL Tests

For each NL test there is a summary of varieties entering the IVT programme through the common catalogue route. The summary focuses on their performance over both test years. The 1-9 ratings listed for the varieties in the relevant test table are presented in bold font. The names of the reference varieties are highlighted in bold font for each test.

Foliage late blight (field) (Tables 7a+b)

The trial was planted in mid-May. The first assessment in 2018 was conducted 9 days after the infector plants were placed in the trial. Late blight lesions were observed at the first assessment and the disease developed well over the assessment period even though the weather conditions were generally very warm and dry. Five assessments were made in total between 27 July and 10 August.

Summary of 2017/2018 trial

There were three first early candidates in the trial and there was slightly more disease recorded in 2018 than 2017. All three candidates were susceptible to foliage late blight scoring between 2.0 and 1.0.

There were seven 2nd early/maincrop candidates and overall there was slightly less disease recorded in 2018 than 2017. No 2nd early/maincrop candidate demonstrated resistance. The most susceptible varieties in trial were Malou (1.0), Vanilla (2.1) and Lady Anna (2.2).

Table 7a. Mean % (angular transformation) Area under Disease Progress in foliage late blight field test in 2017 (1st early varieties)

Variety	Test Year		1-9 rating
	2017	2018	
HOME GUARD	49.3	52.2	2.0
ANGELIQUE	50.0	63.6	1.0
JAZZY	45.5	56.0	2.0
SUNITA	51.4	56.7	1.4
LSD (P=0.05)	5.6	6.1	*

Table 7b. Mean % (angular transformation) Area under Disease Progress in foliage late blight field test in 2016 and 2017 (2nd early/maincrop varieties)

Variety	Test Year		1-9 rating
	2017	2018	
BINTJE	46.0	44.2	3.0
CARA	29.7	29.8	5.7
RUSSET BURBANK	47.4	40.6	3.2
SARPO MIRA	15.2	17.3	8.0
VALOR	32.0	32.3	5.2
ALIBABA	45.5	40.1	3.4
ANTARCTICA	43.8	40.8	3.5
GRAVITY	41.2	41.1	3.7
LADY ANNA	50.4	48.9	2.2
MALOU	54.7	61.2	1.0
ROCK	43.5	36.7	3.9
VANILLA	54.5	46.3	2.1
LSD (P=0.05)	4.5	4.4	1.2*

* For comparisons between varieties trialled in both years

Tuber late blight (Tables 8a+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 2017/2018 trial

Overall there was slightly more disease recorded in 2018 than 2017. In the first early trial, no variety was resistant but Jazzy had the least amount of disease recorded scoring 5.4. Angelique and Sunita were very susceptible, scoring 3.2 and 3.4 respectively.

In the 2nd early/maincrop trial some resistance was observed in Alibaba scoring 6.6. The most susceptible varieties were Malou (1.4), Rock (2.1), Vanilla (2.8 and Lady Anna (3.1).

Table 8a. Mean % (angular transformation) tubers affected by late blight (1st Early varieties)

Variety	Test Year		1-9 rating
	2017	2018	
HOME GUARD	90.0	90.0	2.0
LULU	63.0	71.3	6.0
ANGELIQUE	82.4	83.8	3.2
JAZZY	57.4	83.7	5.4
SUNITA	82.2	82.3	3.4
LSD (P=0.05)	11.7	11.9	*

Table 8b. Mean % (angular transformation) tubers affected by late blight (2nd early/maincrop varieties).

Variety	Test Year		1-9 rating
	2017	2018	
BINTJE	76.6	79.2	2.0
CARA	39.7	54.3	6.0
SARPO MIRA	73.5	70.6	2.8
VALOR	37.7	45.0	6.7
ALIBABA	34.9	50.5	6.6
ANTARCTICA	48.9	51.8	5.6
GRAVITY	56.2	61.0	4.5
LADY ANNA	66.7	71.8	3.1
MALOU	83.5	81.6	1.4
ROCK	79.4	74.4	2.1
VANILLA	73.3	70.7	2.8
LSD (P=0.05)	10.3	12.2	1.2*

* For comparisons between varieties trialled in both years

Blackleg (Table 9)

Up to 2017, reference varieties were tested at 2 sites each year as part of the NL programme. SASA and NIAB (the other UK NL test centre) both conducted 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 2017, and SASA in 2018. The 1-9 score for the candidate varieties is based on the 2017 and 2018 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 2017/2018 trial

Overall there was more blackleg observed in 2018 than 2017, particularly for the candidate Lady Anna. Antarctica was the only candidate to demonstrate resistance with a score of 7.3. Five candidates demonstrated susceptibility, these were Malou (1.0), Rock (1.0), Jazzy (1.7), Sunita (2.2) and Angelique (2.4).

Table 9. Mean % (angular transformation) plants affected by blackleg (*Pectobacterium atrosepticum*)

Variety	Test Year			1-9 rating [^]
	2017 (SASA)	2017 (NIAB)	2018 (SASA)	
AILSA	0.0	3.1	3.1	8.0
CONCURRENT	32.5	35.2	38.2	3.0
CULTRA	9.2	6.1	10.6	7.0
ESTIMA	22.6	42.5	25.0	3.8
MORENE	27.1	33.5	37.1	3.4
ALIBABA	25.4		25.7	4.0
ANGELIQUE	41.8		30.4	2.4
ANTARCTICA	0.0		6.1	7.3
GRAVITY	10.6		14.8	5.9
JAZZY	48.8		32.3	1.7
LADY ANNA	15.0		39.4	3.7
MALOU	58.7		47.8	1.0
ROCK	75.0		59.1	1.0
SUNITA	46.0		28.5	2.2
VANILLA	17.5		33.6	4.0
LSD (P=0.05)	13.3	13.3	12.9	2.9*

[^]NL trial was conducted at 2 sites (SASA and NIAB) in 2017 and 1 site (SASA) in 2018. Reference varieties have data from 2 sites in 2017 and 1 site in 2018; 1-9 rating for candidate varieties have data from SASA only.

* For comparisons between varieties trialled in both years

Common scab (Table 10)

Up to 2017, reference varieties were 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 trial data for SASA in 2018 was excluded by the test centre due to a lack of discrimination. The 1-9 score for the reference varieties is from SASA and NIAB in 2017. The 1-9 score for the candidate varieties are based on the 2017 SASA trials only.

Tubers were planted in pots with infested soil at the end of 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.

The 2018 common scab trial had very low levels of disease overall, with the exception of the reference variety Maris Piper and one of the candidates. The data was excluded due to a lack of discrimination. Due to poor growth on the agar plates prior to inoculation, one of the standard isolates used in the test previously was not used in 2018. Following the assessment of the tubers the isolates used in the trial were tested by PCR and the two isolates were negative for *Streptomyces*.

Summary of 2017 trial

No candidate demonstrated high resistance to common scab with the best performing candidates Angelique, Malou and Lady Anna scoring 5.9, 5.7 and 5.6 respectively. Gravity and Antarctica were the most susceptible candidates scoring 2.9 and 3.4 respectively.

Table 10. Mean % (angular transformation) surface area affected by common scab

Variety	Test Year			1-9 rating [^]
	2017 (SASA)	2017 (NIAB)	2018 (SASA)	
DESIREE	52.9	39.5		3.5
ESTIMA	37.6	36.6		5.1
HOME GUARD	61.9	30.9		3.5
MARIS BARD	57.1	42.7		2.9
MARIS PEER	59.4	33.0		3.5
MARIS PIPER	53.4	56.3		2.0
PENTLAND CROWN	21.9	30.3		7.0
ALIBABA	43.2			5.1
ANGELIQUE	38.3			5.9
ANTARCTICA	52.5			3.4
GRAVITY	55.5			2.9
JAZZY	43.5			5.0
LADY ANNA	40.3			5.6
MALOU	39.6			5.7
ROCK	46.1			4.5
SUNITA	41.3			5.4
VANILLA	49.1			4.0
LSD (P=0.05)	8.1	6.4		5.0*

[^]NL trial was conducted at 2 sites (SASA and NIAB) in 2017. Reference varieties have data from 2 sites in 2017 only. Candidate varieties have data from SASA only in 2017 as the SASA 2018 data was excluded due to a lack of discrimination

* For comparisons between varieties trialled in both years

Powdery scab (Table 11)

Tubers were planted in pots with infested soil in mid-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 2017/2018 trial

There was less disease recorded in 2018 than 2017. In both years, the susceptible reference variety Estima was the most susceptible in trial.

No candidates were susceptible with them scoring between 7.7 and 6.1. Jazzy was the most resistant candidate scoring 7.7.

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

Variety	Test Year		1-9 rating
	2017	2018	
ACCENT	10.5	8.8	7.7
CARA	10.3	8.8	7.7
ESTIMA	36.2	15.3	3.0
PENTLAND CROWN	11.0	8.8	7.6
SANTE	8.1	9.2	8.0
ALIBABA	12.5	9.9	7.2
ANGELIQUE	11.7	10.3	7.3
ANTARCTICA	16.5	12.0	6.4
GRAVITY	13.6	10.2	7.0
JAZZY	10.8	8.8	7.7
LADY ANNA	17.5	9.7	6.6
MALOU	13.9	12.5	6.7
ROCK	13.7	9.2	7.2
SUNITA	19.8	10.4	6.1
VANILLA	19.1	10.2	6.2
LSD (P=0.05)	5.6	2.3	2.5*

* For comparisons between varieties trialled in both years

Dry rot (*Fusarium coeruleum*) (Table 12)

Tubers were inoculated in late 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 2017/2018 trial

There was generally more disease recorded in 2018 than 2017. Malou, Angelique and Antarctica were the most resistant candidates scoring 8.0, 7.6 and 7.5, respectively. Lady Anna (3.8) and Sunita (3.9) were the least resistant.

Table 12. Mean % (angular transformation) internal area affected by *Fusarium coeruleum*

Variety	Test Year		1-9 rating
	2017	2018	
PENTLAND SQUIRE	30.0	45.7	4.5
SANTE	10.4	6.3	8.0
ESTIMA	17.0	43.2	5.4
CATRIONA	59.4	66.7	1.5
NADINE	24.1	20.2	6.4
ALIBABA	26.7	30.0	5.6
ANGELIQUE	11.1	12.0	7.6
ANTARCTICA	11.6	13.3	7.5
GRAVITY	10.6	27.2	6.7
JAZZY	25.0	35.1	5.4
LADY ANNA	43.3	44.9	3.8
MALOU	9.7	6.7	8.0
ROCK	32.9	36.7	4.9
SUNITA	39.1	45.9	3.9
VANILLA	16.3	20.7	6.8
LSD (P=0.05)	7.4	10.4	2.7*

* For comparisons between varieties trialled in both years

Dry rot (*Fusarium sulphureum*) (Table 13)

Tubers were inoculated in late 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 2017/2018 trial

There was more disease recorded in 2018 compared to 2017. Only one candidate, Rock, demonstrated resistance with a score of 8.5. Seven candidates were very susceptible all scoring 1.0, these were Alibaba, Angelique, Jazzy, Lady Anna, Malou, Sunita and Vanilla.

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

Variety	Test Year		1-9 rating
	2017	2018	
ATLANTIC	17.2	30.9	4.7
SAXON	11.3	19.5	6.9
NADINE	9.4	38.5	4.7
SANTE	7.4	15.2	8.0
MARIS PIPER	25.1	36.0	3.0
NECTAR	54.0	53.2	1.0
SYLVANA	10.0	8.5	8.5
ALIBABA	46.6	51.8	1.0
ANGELIQUE	45.1	54.5	1.0
ANTARCTICA	28.1	28.3	3.6
GRAVITY	21.4	39.3	3.1
JAZZY	40.5	56.2	1.0
LADY ANNA	51.2	50.5	1.0
MALOU	35.1	50.4	1.0
ROCK	8.1	10.4	8.5
SUNITA	43.3	60.9	1.0
VANILLA	60.3	63.3	1.0
LSD (P=0.05)	10.7	10.7	4.3*

* For comparisons between varieties trialled in both years

External damage (splitting) (Tables 14a+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 2017/2018 trial

In the 1st early trial there was a lower level of splitting observed in 2018 than 2017. Two candidates had no splitting in either year. This test can be influenced by environmental factors. In the 1st early trial, there was a large difference in performance between years for reference variety Ulster Sceptre. The results and the tubers were checked and were correct. Jazzy and Sunita had no splitting recorded in either year of the trial, the other candidate Angelique was very susceptible with a score of 1.0. In the 2nd early/maincrop no candidate demonstrated susceptibility. Antarctica (6.5) was the most resistant candidate with no splitting recorded in either year.

Table 14a. Mean % tubers affected by splitting after applying standard force (1st early varieties)

Variety	Test Year		1-9 rating
	2017	2018	
ULSTER SCEPTRE	40.0	0.0	4.1
HOME GUARD	3.3	0.0	6.3
ANGELIQUE	91.9	70.6	1.0
JAZZY	0.0	0.0	6.5
SUNITA	0.0	0.0	6.5

Table 14b. Mean % tubers affected by splitting after applying standard force (2nd early/maincrop varieties)

Variety	2017	Test Year 2018	1-9 rating
MARIS PEER	6.0	20.0	4.9
MARIS PIPER	3.9	2.0	6.1
RECORD	4.0	3.9	6.0
RED CRAIGS ROYAL	30.0	29.4	2.9
RUSSET BURBANK	32.0	25.0	3.1
ALIBABA	2.0	9.8	5.8
ANTARCTICA	0.0	0.0	6.5
GRAVITY	12.0	4.0	5.5
LADY ANNA	10.0	19.6	4.7
MALOU	12.0	29.4	4.0
ROCK	12.0	7.8	5.3
VANILLA	5.9	7.8	5.7
LSD (P=0.05)			2.8*

* For comparisons between varieties trialled in both years

Internal damage (bruising) (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 measuring the depth of internal damage at the point of impact.

Summary of 2017/2018 trial

In the 1st early trial, there was slightly less bruising recorded in 2018 compared to 2017. None of the candidates demonstrated high resistance to internal damage. They all performed similarly scoring between 5.8 and 5.0. Overall there was not a large variation between performances in the bruising recorded in the 2nd early/maincrop trial. Lady Anna, Alibaba and Vanilla were the best performing candidates scoring 6.6, 6.3 and 6.3 respectively. Malou, with a score of 3.8 was the candidate with the most bruising recorded.

Table 15a. Mean depth (mm) of bruise at point of impact of standard (1st early varieties)

Variety	2017	Test Year	
		2018	1-9 rating
ULSTER SCEPTRE	6.8	4.2	3.3
HOME GUARD	3.2	2.5	5.5
ANGELIQUE	3.6	3.2	5.0
JAZZY	3.1	1.8	5.8
SUNITA	3.2	2.4	5.5

Table 15b. Mean depth (mm) of bruise at point of impact of standard force (2nd early/maincrop varieties)

Variety	2017	Test Year	
		2018	1-9 rating
MARIS PEER	4.1	5.1	4.0
MARIS PIPER	2.6	1.8	6.0
RECORD	3.4	5.7	4.1
RED CRAIGS ROYAL	2.7	3.1	5.4
RUSSET BURBANK	4.6	4.7	4.0
ALIBABA	1.9	1.8	6.3
ANTARCTICA	3.4	3.0	5.2
GRAVITY	4.8	2.1	5.0
LADY ANNA	0.9	1.9	6.6
MALOU	3.5	6.3	3.8
ROCK	3.2	2.0	5.7
VANILLA	2.7	1.1	6.3
LSD (P=0.05)			1.8*

* For comparisons between varieties trialled in both years

Potato Cyst Nematode (Table 16)

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 Angelique, Lady Anna, Rock and Sunita.

The candidate Malou showed high resistance to *G. pallida*.

Table 16. 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)	2 (S)
ESTIMA	2 (S)	*	*
MARIS PIPER	8 (R)	2 (S)	1 (S)
12380	8 (R)	6	6
VANTAGE	5	5	6
MORAG	6	3	3
VALES	*	6	9 (R)
EVEREST	*	6	9 (R)
INNOVATOR	*	9 (R)	9 (R)
ALIBABA	3	2	2
ANGELIQUE	8	1	*
ANTARCTICA	1	1	*
GRAVITY	2	2	2
JAZZY	2	2	2
LADY ANNA	9	2	3
MALOU	2	8	8
ROCK	9	3	3
SUNITA	9	2	1
VANILLA	2	1	*

† S denotes susceptible reference varieties and R denotes highly resistant reference varieties

* not tested

6. 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 both dry rots, disease severity was greater in 2018 than in 2017, whereas the incidence of black dot and powdery scab was less in 2018 than 2017. 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. The 2018 mop top (spraing) data was excluded from the analysis due to low levels of disease. The 2018 common scab trial data was excluded due to a lack of discrimination.

The very warm and dry weather in summer 2018 influenced some trials such as the powdery scab trial where lower disease levels were recorded that year. Powdery scab development is favoured by wetter conditions and even with irrigation the trial had low levels of disease. It was possible that during the hot summer of 2018, soil temperatures were frequently outside the optimum range for infection between 9°C and 17°C. As mentioned earlier in the report the susceptible reference variety Estima still recorded the highest level of powdery scab in the 2018 trial. The warm temperatures also impacted the mop top (spraing) test which led to very low levels of disease recorded in 2018 leading to the exclusion of the data in the final analysis. The disease in the late blight trial on the west coast of Scotland had very good disease development even with the warm, dry weather. Disease developed quickly and assessments were made over a 2 week period.

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 14 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 Table 2, 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 individual test tables (Tables 3-16) show the performance over the test years and the 1-9 score here can vary slightly from those in Table 2.

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 factors such as the level of inoculum likely to be present and whether environmental conditions favour the pathogen.

Thirteen varieties completed IVT in 2018. These were Andeana, Inca Rosa, Harry, Alibaba, Angelique, Antarctica, Gravity, Jazzy, Lady Anna, Malou, Rock, Sunita and Vanilla. An overview of strengths and weaknesses for these varieties is listed on pages 8 and 9 of this report. Scores for these varieties have been published on the AHDB Potatoes Variety Database (<https://varieties.ahdb.org.uk>). This database which was initially 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. The database was upgraded in 2014 and new features were added such as the ability to compare two varieties on one screen and the option to download data into Excel.

7. REFERENCES

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8. APPENDIX 1 – IVT SPECIFIC TEST PROTOCOLS

A.1 Skin spot (*Polyscytalum pustulans*)

Methodology

Susceptibility to skin spot (*Polyscytalum pustulans*) is assessed by planting inoculated seed tubers in pots and recording the severity of skin spot on the daughter tubers, after appropriate incubation. Spores are washed from a culture of *P. pustulans* maintained on 2% malt extract agar. A small portion of the spore suspension is poured on to 8.5 cm diameter petri dishes containing malt extract and the suspension drained off. These plates are incubated for a minimum of 14 days before being macerated at the rate of c. 1.5 plates L⁻¹ sterile distilled water (Carnegie & Cameron, 1983 Testing potato cultivars for susceptibility to skin spot (*Polyscytalum pustulans*). *Potato Research* **26**: 69-72). Test tubers are dipped in the suspension of mycelia and spores for 0.5 minutes and planted immediately in pots. The pots, each c. 25 cm in diameter, are half filled with the compost mixture before placing an inoculated seed tuber in the pot and covering with compost.

Plot Size and Trial Design

Pots are laid out in a randomised block design with 6 replications.

Cultivations

The compost is a 1:1 mix of Bulrush compost and John Innes No 2 compost. Pots are spaced c. 5cm apart and are sunk in outdoor peat beds. Plants are watered by drip irrigation. The haulm is killed, if necessary, by applying diquat dibromide (Reglone) at half the recommended rate in mid-August to allow the fungus to develop on the senescing underground stolons. Tubers are harvested c. 5 weeks after haulm destruction and all tubers greater than 15 mm are stored at 5-8°C until symptoms develop.

Disease Assessment

The severity of skin spot is scored, according to Boyd (1957) (Field experiments on potato skin spot disease caused by *Oospora pustulans* Owen & Wakef. *Annals of Applied Biology* 45: 284-292), in 5 categories: nil (0); trace (1) = up to 10 pustules; slight (5) = from trace up to 10% surface area affected; moderate (17.5) = between >10% and 25% surface area affected; severe (67.5) = 25% surface area affected or >. A susceptibility index is calculated by multiplying the number of tubers in each category by the mid-point value shown in brackets above and dividing the total by the number of tubers examined.

Submission of Data

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

A.2 Black dot (*Colletotrichum coccodes*)

Methodology

Susceptibility to black dot (*Colletotrichum coccodes*) is assessed by planting test seed tubers in pots containing artificially-infested compost and recording the severity of black dot on the daughter tubers, after appropriate incubation. Prior to planting, tubers are chitted in a growth cabinet set at 10°C under light to break dormancy. Cultures of 3 isolates of *C. coccodes* will be prepared on Potato Dextrose Agar (PDA). After one week, when the colony has reached the edge of the plate, cultures are macerated using a liquidiser. These are 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. The compost is then placed in circular pots, 25cm in diameter, and a tuber is planted in each pot at a depth of c. 7.5 cm.

Plot size and Trial Design

Pots are laid out in a randomised block design with 6 replications.

Cultivations

Pots are placed in a polytunnel on individual trays to avoid cross-contamination and watered at least twice weekly to maintain the water content at 40 – 60% of the water holding capacity. Plants are allowed to senesce naturally and, once haulm is completely dead, the daughter tubers are harvested.

Plants are sprayed with potato late blight fungicides at 10 day intervals and with aphicides, if necessary. Once a week when watering the pots, liquid fertiliser will be applied at the rate of 1 scoop of Phostrogen per 2 gallons (9 litres) water.

Disease Assessment

The % surface area affected by black dot is assessed on all daughter tubers over 10mm in each pot at harvest.

Submission of Data

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

A.3 Silver scurf (*Helminthosporium solani*)

Methodology

Susceptibility to silver scurf (*Helminthosporium solani*) is assessed by planting test seed tubers in 24-28 cm pots containing infested compost. After appropriate incubation, the severity of silver scurf on the daughter tubers is recorded. At least 2 isolates of *H. solani* will be used in the test. Petri dishes containing 2% malt extract agar are seeded by pouring a small quantity of a spore/mycelia suspension over the surface of the agar. After a minimum of 14 days incubation, plates are macerated in sterile distilled water at the rate of 6 dishes L⁻¹ sterile distilled water. Infested compost will be prepared in a cement mixer at the rate of 1L of suspension to 42 L of compost.

Plot Size and Trial Design

Pots are laid out in a randomised block design with 6 replications.

Cultivations

Pots are spaced c. 5cm apart in a polytunnel. Plants are watered by seep irrigation and are allowed to senesce naturally. After harvest, all tubers over 15 mm are stored at c.

15°C and high humidity until lesions are well developed on the susceptible control varieties.

Disease Assessment

The % surface area affected by silver scurf is scored in 6 categories: 0-1, >1-10, >10-25, >25-50, >50-75 and >75-100. A severity score for each plot is calculated 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.

Submission of Data

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

A.4 Mop-top virus spraing

Methodology

Susceptibility to Mop-top virus spraing is assessed in an area previously contaminated with powdery scab/PMTV by planting the test and control varieties (Cara, Nicola, Valor, Saturna and Maris Piper) and recording the severity of Mop-top virus spraing on the harvested tubers. Potatoes of a stock showing both PMTV and powdery scab symptoms are peeled in a commercial peeler and the slurry collected. The slurry is spread evenly across a bed 30m x 12m and the slurry incorporated. The soil is further mixed by cultivations. Contamination by both the powdery scab organism and PMTV is confirmed by a direct soil test and bioassay followed by PCR respectively.

Plot Size, Trial Design and Cultivation

Test and control varieties are planted in randomised blocks with 6 replicates. The plots will be irrigated during the season. Each plot consists of 3 tubers.

Disease Assessment

All tubers from each of the 6 replicates are assessed individually. After harvest the tubers are placed in an ambient store (c 18°C) for 3 weeks before placing in a cold store at 4°C. After a further month, tubers are assessed for visual symptoms of PMTV spraing by cutting. Susceptibility will be expressed as the average percentage of the tubers showing symptoms. Varieties will be tested for a minimum of 2 seasons.

Submission of Data

Trial results must be sent to the Trials Organiser by 31 January