Evaluation of processing potato cultivars and lines for Simplot in Tasmania 2007

Dr Philip Brown
University of Tasmania

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Level 7
179 Elizabeth Street
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Telephone: (02) 8295 2300
Fax: (02) 8295 2399
E-Mail: horticulture@horticulture.com.au

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August 2008

Dr Phil Brown

Tasmanian Institute of Agricultural Research

Project Title:	Evaluation of processing potato cultivars and lines for Simplot in Tasmania 2007
Project Number:	HAL PT07003
Project Leader:	Dr Phil Brown

Tasmanian Institute of Agricultural Research
University of Tasmania
Private Bag 98
Hobart
Tasmania 7001
Phone: 61 3 6226 2716 Fax: 61 3 6226 7450
E-mail : Phil.Brown@utas.edu.au

Technical support: Leon Hingston

This report describes the work carried out by the project team for 2007-2008 on behalf of Simplot Australia. This work continues the evaluation of selected processing potato cultivars and lines in Tasmania for the production of French fries and associated product. This work was previously carried out by the Tasmanian Institute of Agricultural Research on behalf of processing companies and growers with contribution from HAL potato levy funds (see final report PT96005 for such project work between 1996-2003). Since that time, Simplot Australia have wished to further compare new genotypes generated from the Australian potato breeding program with commercial standard cultivars (see final reports PT03029, PT04018, PT05015 and PT06001 for seasons' 2003-2004 through to 2006-2007), with support of matched voluntary contributions to HAL.

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4. Lyndon Butler, Tasmanian Institute of Agricultural Research, who has helped with field operations.
5. Dr Tony Slater, IHD

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Media Summary

Evaluation of the commercial processing potential (for French fry production) of new potato genotypes has been ongoing in Tasmania for several years. This work was previously carried out by the Tasmanian Institute of Agricultural Research on behalf of processing companies and potato growers with contribution from HAL potato levy funds. A final report of such project work between 1996-2003 (PT 96005) was accepted by HAL in September 2003. Since that time, Simplot Australia have wished to further compare new genotypes generated from the Australian potato breeding program with commercial standard cultivars (see final reports PT03029, PT04018, PT05015 and PT06001 for seasons' 2003-2004 through to 2006-2007), with support of matched voluntary contributions to HAL. With the continuing need for improved yield and quality for French fries and other processed products, Simplot Australia requested further comparison of new genetic material with commercial standard cultivars in the season 2007-08, with support of matched voluntary contributions from HAL.

Nineteen new potato varieties and three standard commercial cultivars were planted at Forthside Research Station in North-West Tasmania in November 2007. The trial, managed according to local commercial practice, was allowed to senesce naturally and was harvested in May 2008. From data collected for yield and quality parameters, seven of the new genotypes displayed enough potential to warrant further investigation.

An additional field comparison of seven cultivars, selected from the 2006-2007 field trial at Forthside Research Station, and three standard commercial cultivars was planted in November 2007. This trial, managed according to local commercial practice, was allowed to senesce naturally and harvested in May 2008. From data collected for yield and quality parameters, four of the new lines displayed enough potential to warrant further investigation. Two of these cultivars have been tested and released into the Tasmanian Certified Seed Potato scheme for multiplication prior to intense agronomy profiling work starting in 2008-09. The remaining two lines have begun the process of reintroduction into the Tasmanian Certified Seed Potato Scheme but given the various testing procedures involved, it is unlikely that these cultivars will be available for further testing by Simplot Australia prior to 2009-2010.

This report provides the results for 2007-08 obtained by the project team on behalf of Simplot Australia.

Technical Summary

Nineteen new potato genotypes from the Australian Processing Potato Improvement Program (APPIP) at Toolangi and three standard commercial cultivars were planted at the Forthside Research Station (FRS) in North-West Tasmania on 10 November 2007. For the purposes of this report, this trial is referred to as Stage 1.

Seven cultivars, selected from the 2006-2007 field comparison at FRS, were planted on 9 November 2007 with three standard commercial cultivars being used as controls for this evaluation. This trial is referred to as Stage 2 for this report.

Trial design for the Stage 1 trial was a randomised complete block containing three replicates with an individual plot size of 8.2m^2 (2 rows x 5 metres). For the Stage 2 trial, the design was a randomised complete block containing three replicates with an individual plot size of 19.68m^2 (2 rows x 12 metres). A sub-sample of 8.2m^2 (2 rows x 5 metres) was used for harvest with the remainder of the total plot area being used for collecting additional plant growth data. Both trials were sited on red ferrosol soil, and were managed according to current commercial husbandry practices for the industry standard cultivar Russet Burbank. Trials were managed by TIAR and funded by a voluntary contribution arrangement between Simplot and HAL. Both trials were allowed to senesce naturally and were harvested on 20 May 2008. TIAR staff maintained records for the trials throughout growth and during harvest assessment. Tuber yield, its components and quality parameters indicative of the lines' processing suitabilities were recorded. Harvest notes and ratings were made by Simplot Australia research and field services personnel.

Due to the changing nature of processing potato markets, of the nineteen new lines investigated in the Stage 1 trial, twelve were French fry types, four were crisping types and three cultivars were considered suitable as wedging types. Eight French fry genotypes were significantly better yielding than the industry standard Russet Burbank for processing yield. All wedge and crisping type cultivars had higher processing yields than Russet Burbank though this could not be confirmed statistically due to the different parameters employed to assess processing yield for both these types. Specific gravity was within acceptable commercial tolerances for all entries, with 1.088 for Russet Burbank and 1.085 for Shepody. Powdery scab levels were varied throughout the trial site, with differences in tolerance being noted both at harvest and processing.

There were seven new genotypes that showed some promise in the Stage 1 trial. At the time of this report, a decision is still pending on what Simplot Australia intend to do with these genotypes.

Of the seven genotypes investigated in the Stage 2 trial, four were French fry types, one was a crisping type and two lines were considered suitable as wedging types. Though three French fry genotypes yielded higher than the industry standard Russet Burbank for processing yield, this could not be validated statistically. Both wedge type cultivars had higher processing yields than Russet Burbank though this could not be confirmed statistically due to the different parameters employed to assess processing yield for both these types. Specific gravity was within acceptable commercial tolerances for all entries, with 1.090 for Russet Burbank and 1.086 for

Shepody. With the exception of Shepody, powdery scab levels were generally low throughout the trial site, with differences in tolerance being noted both at harvest and processing.

Four cultivars from this trial displayed enough potential to warrant further investigation. Two of these cultivars have been tested and released into the Tasmanian Certified Seed Potato scheme for multiplication prior to intense agronomy profiling work starting in 2008-09. The remaining two lines have begun the process of reintroduction into the Tasmanian Certified Seed Potato Scheme but given the various testing procedures involved, it is unlikely that these cultivars will be available for further semi-commercial testing by Simplot Australia prior to 2009-2010.

Introduction

Potato genetic improvement through the breeding and evaluation of potato genotypes and cultivars has been seen to be an important part of Australia's potato research portfolio. The Tasmanian industry has benefited from the introduction and testing of genotypes such as Nooksack, Umatilla Russet and Ranger Russet by APPIP. In more recent seasons, the breeding program's increased focus on processing potato genotypes has led to a greater proportion of Australian-bred material flowing through to commercial development. The time-lines associated with the latter, however, dictate that these genotypes have yet to enter commercial use.

Evaluation of new potato genotypes for French fry production in Tasmania was previously carried out by the Tasmanian Institute of Agricultural Research on behalf of processing companies and potato growers with contribution from HAL potato levy funds. A final report of such project work between 1996-2003 (PT 96005) was accepted by HAL in September 2003. Changes to the funding arrangements for this work left some early generation selections in need of further evaluation and Simplot Australia requested further comparison of these lines with commercial standard cultivars in the season 2003-04, with support of matched voluntary contribution to HAL. A final report of such project work (PT03029) was accepted by HAL in October 2004. Since that time, Simplot Australia have wished to further compare new genotypes generated from the Australian potato breeding program with commercial standard cultivars (see final reports PT04018, PT05015 and PT06001 for seasons' 2004-2005 through to 2006-2007), with support of matched voluntary contributions to HAL. With the continuing need for improved yield and quality for French fries and associated processed product, Simplot Australia requested further comparison of new genetic material with commercial standard cultivars in the season 2007-08, with support of matched voluntary contribution from HAL.

This report provides the results obtained by the project team for 2007-08 on behalf of Simplot Australia.

Industry involvement and research collaboration

Throughout the 2007-08 season, personnel representing J.R. Simplot Australia have observed the performance of the introduced lines and have been instrumental in making selections for ongoing evaluation.

The work also has involved collaboration with Dr Tony Slater, coordinator of the APPIP Toolangi national program, who provided the new genotypes for evaluation.

General Methodology

After initial in-situ selection by Mark Heap, Bioscience Manager for Simplot Australia, approximately 10kg of seed tubers of each of nineteen lines were received from the APPIP Toolangi breeding program and planted, on 10 November 2007, in one field comparison at FRS, near Devonport in North-West Tasmania. The current commercial standards, Russet Burbank, Shepody and Ranger Russet (sourced from Toolangi in order to have the same generational attributes as the new genotypes) were used as controls for this evaluation. For reporting purposes this evaluation is referred to as the Stage 1 trial.

Seven genotypes, selected from the 2006-2007 field comparison at FRS, were planted on 9 November 2007. The current commercial standards, Russet Burbank, Shepody and Ranger Russet (sourced from the 2006-2007 FRS field comparison in order to have the same generational attributes as the evaluated genotypes) being used as controls for this evaluation. For reporting purposes this evaluation is referred to as the Stage 2 trial.

Trial design for the Stage 1 trial was a randomised complete block containing three replicates and plot size was 8.2m^2 (two rows, each five metres long). For the Stage 2 trial, the design was a randomised complete block containing three replicates with an individual plot size of 19.68m^2 (2 rows x 12 metres). A sub-sample of 8.2m^2 (2 rows x 5 metres) was used for harvest with the remainder of the total plot area being used for collecting additional plant growth data. For both trials, plots were buffered and separated in-row by commercial, distinctively coloured tuber cultivars and current commercial husbandry practices were used. Tuber yield and quality parameters indicative of lines' processing suitabilities were recorded and analysed.

After commercial standard practices of land preparation, trials were established as follows;

- Stage 1 trial
    1. 315 kg/ha muriate of potash + 40 kg/ha zinc sulphate applied and incorporated pre-planting.
    2. Plots were planted by hand into open furrows formed by a Faun potato planter, with which 11:16:06 fertiliser was band placed at a rate of 1830 kg/ha.
    3. The seed tubers were covered in the row and plants were hilled at approximately 50 per cent row cover.
    4. The commercial standard cultivars, Russet Burbank, Ranger Russet and Shepody were planted at sett spacings of 325mm, 250mm and 200mm respectively. Sett spacings for new genotypes ranged from 225mm to 275mm.
- Stage 2 trial
    1. 315 kg/ha muriate of potash + 40 kg/ha zinc sulphate applied and incorporated pre-planting.
    2. Plots were planted by a Faun potato planter, with which 11:16:06 fertiliser was band placed at a rate of 1830 kg/ha for all cultivars except FRSST2-02, with which 6:16:06 fertiliser was band placed ata rate of 1830 kg/ha.
    3. Plots were rehilled when plants were at approximately 50 per cent row cover.
    4. The commercial standard cultivars, Russet Burbank, Ranger Russet and Shepody were planted at sett spacings of 320mm, 260mm and 200mm respectively. Sett spacings for new genotypes ranged from 260mm to 290mm.

For both trials, two applications of 20:0:20 at 250 kg/ha were applied (by top-dressing) at four and ten weeks post planting. Fertiliser application rates and timings were determined by Mark Heap (Simplot Australia), in accordance with Russet Burbank production for the local area. Soil nutrient analysis was conducted by CSBP Soil and Plant Laboratory in Western Australia.

Weeds were controlled with a pre-emergent application of Sprayseed® and Lexone® at rates of 2 L/ha and 350gms/ha respectively, and by mechanical means, as required, after emergence. Fungicides were applied as per usual local commercial practice with a spray program utilising Barrack500® (at a rate of 1.5 L/ha), Score® (at a rate of 0.3 L/ha) and Penncozeb750DF® (at a rate of 2.2 kg/ha) as required. Rows were spaced at 810mm intervals.

Both trials, grown through to maturity, were allowed to senesce naturally and harvested on 20 May 2008. Selections were made from these trials through joint observation and discussion between Simplot R&D manager Mr Mark Heap, Simplot field officers and TIAR staff.

Tuber yield parameters :

French fry types (for both Stage 1 and Stage 2 trials)
Samples were graded by tuber weight into the following components;

0 to 80 grams
80 to 250 grams
250 to 650 grams
650 to 850 grams
>850 grams
Mishapen/distorted tubers
Cracked tubers
Diseased tubers

Combinations of the above components provided total, ware and waste grade yields. Plant counts at emergence provided tuber numbers per plant, a commercially accepted measure of yield potential.

Wedging types (for both Stage 1 and Stage 2 trials)
Samples were graded by tuber weight into the following components;

0 to 80 grams
80 to 200 grams
200 to 400 grams
400 to 600 grams
600 to 850 grams
>850 grams
Mishapen/distorted tubers
Cracked tubers
Diseased tubers

Combinations of the above components provided total, ware and waste grade yields. Plant counts at emergence provided tuber numbers per plant, a commercially accepted measure of yield potential.

Crisping types (for both Stage 1 and Stage 2 trials)
Samples were graded by tuber size into the following components;

0 to 40mm
40 to 60mm
60 to 80mm
80 to 100mm
>100mm
Mishapen/distorted tubers
Cracked tubers
Diseased tubers

Combinations of the above components provided total, ware and waste grade yields. Plant counts at emergence provided tuber numbers per plant, a commercially accepted measure of yield potential.

Tuber quality parameters :

Flesh colour
Uncooked flesh colour assessed by the following scale;
1 = white
2 = off/creamy white
3 = cream
4 = dark cream
5 = yellow

Powdery scab rating
As per appendix B

Days to maturity
Number of days from planting to full senescence.

Bruising protocol
Tube length = 60cm
Ball bearing weight = 130gms
Ball bearing diameter = 3cm
Five tubers were randomly selected from the ware tuber grades. Four target spots were marked (with liquid paper) on each tuber (two at rose end and two at stem end). With the tuber firmly placed under tube to absorb full impact, the ball bearing was dropped once on each target spot. Samples were stored at 20C for twenty-four hours then target spots were peeled and bruise severity recorded as per score sheet (ratings 0=nil to 9=severe). In addition to this, an overall score of tuber shattering severity was recorded for each sample (0 = nil, 1 = slight, 2 = moderate, 3 = severe).

Dry matter
This was estimated using specific gravity (weight in water, weight in air method). A sample of approximately 2kg of tubers was tested from each plot. Specific gravity results were then converted to dry matter percentage as per the Toolangi method
Percentage Dry matter = (specific gravity-0.983214)/0.004813

Fry colour protocol
This test was based on the methods used by the intake laboratory at the Ulverstone factory of Simplot Australia. One 10mm section French fry was cut from the centre of ten tubers for each plot. These strips were washed and dried before cooking. Fries were cooked for 150 seconds at a temperature of 190 C in Cottonseed oil. To maintain an acceptable commercial standard, the oil was changed after every fifty samples. Overall colour of each fry was scored as per the USDA 1988 French fry colour chart, a scale of 000, 00, 0, 1, 2, 3 and 4 with 000 being white and 4 being dark gold. A score of 0 or less was acceptable. These individual fry ratings were then represented as a percentage of the entire sample. The percentage of "dark ends" (sugar accumulation and subsequent caramelisation after cooking) was noted for each sample.

Internal Defects protocol
For each sample, ten tubers were cut from the largest size grade available to assess internal defects, principally hollow heart. If any tubers were detected with defects a further ten tubers from the next lower size grade were cut and results recorded.

Additional Parameters (for Stage 2 trial only)
In accordance with the E.J.Allen model (see HAL final report PT05030), Stage 2 trial methodology was modified with the adoption of the following procedures.

Emergence date
Plant emergence was recorded every 3-4 days until 50% of planted tubers had produced at least one stem. Recording continued until 100% of tubers had produced at least one stem.

Tuberisation date
From 20 days post 50% emergence, four plants were harvested every 3-4 days until all sampled plants had at least one tuber swelling twice the diameter of stolon. This determined the date on which 100% of plants had produced tubers.

Percentage ground cover (to estimate the rate of canopy development)
Using digital imaging, canopy growth rate was recorded from 50% plant emergence until full canopy cover.

Stems per plot
At plot senescence, the number of stems for each plot was recorded.

Stage 1 trial Results

Due to the different grading methods employed to assess tuber yield and number variates for French fry, wedging and crisping genotypes, lines were grouped according to their specific type for analysis of variance. Table 6 contains the data collected for tuber yield and number parameters for the Stage 1 trial French fry genotypes and associated standard commercial cultivar check plots. Tables 7 and 8 contain the data collected for tuber yield and number parameters for wedging and crisping types respectively.

All remaining variates (maturity period, Powdery scab rating, bruise susceptibility, dry matter content, fry colour and internal defects) were processed by the same method regardless of type and accordingly, all genotypes and cultivars were grouped and analysed together. Thus Table 9 contains the data collected for quality parameters for all genotypes.

Table 10 contains the observations made throughout the growing season, at harvest and at processing for general plant and tuber appearance for all genotypes and cultivars.

For French fry types (Table 6), a total of ten genotypes (**FRSST1-01**, **FRSST1-02**, **FRSST1-03**, **FRSST1-04**, **FRSST1-05**, **FRSST1-06**, **FRSST1-08**, **FRSST1-09**, **Ranger Russet** and **Shepody**) had significantly higher fry-grade yields than **Russet Burbank** ($P<0.05$). **FRSST1-01** had significantly higher tuber numbers per plant than **Russet Burbank** ($P<0.05$) whilst nine cultivars (**FRSST1-03, FRSST1-04, FRSST1-06, FRSST1-08, FRSST1-09, FRSST1-10, FRSST1-12, Ranger Russet** and **Shepody**) had significantly lower tuber numbers per plant than the commercial standard ($P<0.05$).

For wedging type cultivars (Table 7), there was no significant difference between genotypes for total and fry-grade yields, whilst **FRSST1-13** had significantly fewer tubers per plant than **FRSST1-14** ($P<0.05$). All wedging genotypes had higher processing yields than **Russet Burbank** though this could not be confirmed statistically due to the different parameters employed to assess fry-grade yield for these types.

For crisping genotypes (Table 8), **FRSST1-16** and **FRSST1-17** had significantly higher fry-grade yields than **FRSST1-18** and **FRSST1-19** ($P<0.05$), with **FRSST1-19** also having a significantly lower total yield than the other three genotypes ($P<0.05$). **FRSST1-18** had significantly more tubers per plant than the other three genotypes ($P<0.05$). All crisping genotypes had higher processing yields than **Russet Burbank** though this could not be confirmed statistically due to the different parameters employed to assess fry-grade yield for these types.

Specific gravity (Table 9) was within acceptable commercial tolerances for all entries, with 1.088 for **Russet Burbank** and 1.085 for **Shepody**. Five genotypes (**FRSST1-02**, **FRSST1-09**, **FRSST1-12**, **FRSST1-16** and **FRSST1-17**) had significantly higher specific gravities than **Russet Burbank** ($P<0.05$). **FRSST1-07** was observed to have significantly lower solids than the industry standard ($P<0.05$). It should be noted that

none of the cultivars or genotypes tested had specific gravity readings below the minimum industry acceptance level of 1.070.

Powdery scab incidence was noted both at harvest and processing (see Table 9). Twelve genotypes (**FRSST1-05, FRSST1-06, FRSST1-07, FRSST1-08, FRSST1-09, FRSST1-11, FRSST1-12, FRSST1-14, FRSST1-15, FRSST1-16, FRSST1-19** and **Ranger Russet**) had statistically similar levels of Powdery scab infestation to those of **Russet Burbank** ($P<0.05$). All other genotypes and cultivars had significantly higher levels than the industry standard ($P<0.05$).

Statistically, there was no difference in observed maturity periods for all genotypes

With the exception of **FRSST1-03** and **FRSST1-07,** fry colour for all evaluated genotypes was within commercially acceptable limits. All other genotypes were similar in overall fry colour to the industry standard. Very low proportions of darker overall fry colour were observed for **FRSST1-03** and **FRSST1-07** but these differences could not be confirmed statistically. In addition to overall fry colour, colour consistency is a major factor in determining commercial suitability of new potato genotypes. **FRSST1-03**, **FRSST1-07**, and **FRSST1-08** displayed a degree of colour variation within their respective samples. **FRSST1-05** had significantly higher proportions of “dark ends” (after cook darkening caused by sugar accumulation at the ends of tubers), to those of **Russet Burbank** ($P<0.05$).

All evaluated genotypes had significantly lower levels of total internal defects to that of **Russet Burbank** ($P<0.05$).

Stage 2 trial Results

Due to the different grading methods employed to assess tuber yield and number variates for French fry, wedging and crisping genotypes, lines were grouped according to their specific type for analysis of variance. Table 1 contains the data collected for tuber yield and number parameters for the Stage 2 trial French fry genotypes and associated standard commercial cultivar check plots. Tables 2 and 3 contain the data collected for tuber yield and number parameters for wedging and crisping types respectively.

All remaining variates (maturity period, Powdery scab rating, bruise susceptibility, dry matter content, fry colour and internal defects) were processed by the same method regardless of type and accordingly, all genotypes and cultivars were grouped and analysed together. Thus Table 4 contains the data collected for quality parameters for all genotypes.

Table 5 contains the observations made throughout the growing season, at harvest and at processing for general plant and tuber appearance for all genotypes and cultivars.

Appendix C contains the data for emergence, tuber initiation, canopy development and rate of senescence as per the E.J.Allen model (HAL final report PT05030).

For French fry types (Table 1), there was no significant difference between all evaluated genotypes and **Russet Burbank** for total and fry-grade yields ($P<0.05$). All genotypes had significantly lower tuber numbers per plant than **Russet Burbank** ($P<0.05$).

For wedging type cultivars (Table 2), there was no significant difference between genotypes for total and fry-grade yields, whilst **FRSST2-06** had significantly fewer tubers per plant than **FRSST2-05** ($P<0.05$). All wedging genotypes had higher processing yields than **Russet Burbank** though this could not be confirmed statistically due to the different parameters employed to assess fry-grade yield for these types.

Statistical analysis was not performed on the crisping genotype (Table 3), for tuber yield and number variates. **Russet Burbank** had a higher processing yield than **FRSST2-07** though this could not be confirmed statistically due to the different parameters employed to assess fry-grade yield for these types.

Specific gravity (Table 4) was within acceptable commercial tolerances for all entries, with 1.090 for **Russet Burbank** and 1.086 for **Shepody**. Two genotypes (**FRSST2-01** and **FRSST2-05**) were observed to have significantly lower solids than the industry standard **Russet Burbank** ($P<0.05$). It should be noted that none of the cultivars or genotypes tested had specific gravity readings below the minimum industry acceptance level of 1.070.

Powdery scab incidence was noted both at harvest and processing (see Table 4). Four genotypes (**FRSST2-02, FRSST2-05, FRSST2-06** and **Shepody**) had significantly higher levels of Powdery scab infestation than the industry standard ($P<0.05$). All other genotypes and cultivars had statistically similar levels to **Russet Burbank** ($P<0.05$).

Three genotypes (**FRSST2-02, FRSST2-05** and **FRSST2-06**) were significantly later maturing than **Russet Burbank** ($P<0.05$) whilst **FRSST2-03** matured significantly earlier than the industry standard.

Fry colour for all evaluated genotypes was within commercially acceptable limits. Statistically**, Ranger Russet** had a darker overall fry colour than **Russet Burbank** ($P<0.05$) whilst **FRSST2-01** had significantly lighter overall fry colour ($P<0.05$). Colour consistency is a major factor in determining commercial suitability of new potato genotypes. With the exception of **FRSST2-02** and **Shepody**, all genotypes displayed minimal colour variation within their respective samples. With the exception of **Shepody,** all cultivars and genotypes had statistically similar proportions of "dark ends" (after cook darkening caused by sugar accumulation at the ends of tubers), to that of **Russet Burbank** ($P<0.05$).

All genotypes and cultivars had significantly lower levels of total internal defects than **Russet Burbank** ($P<0.05$).

In order to identify the productive potential of varieties, additional data was captured for this trial (as outlined in the methodologies for HAL final report PT05030). Statistical differences were noted for plant emergence (for both 50% and 100% assessments), days to maturity, stems per plant, tuber number per plant, total and fry-grade yields (see Appendix C). Differences were also observed for canopy growth rates, tuber initiation dates and commencement of plant senescence but could not be confirmed statistically as the assessments were for one replicate only. From data collected, several observations were made as follows;

1. **FRSST02-06** and **FRSST207** had significantly higher stems per plant than all other genotypes ($P<0.05$). Accordingly, total yields could be increased for these two genotypes by reducing plant density and consequently increasing tuber size.
2. Though this could not be confirmed statistically, **FRSST02-02** had relatively slower rates of plant emergence, tuber initiation and canopy development. With a significantly later maturity ($P<0.05$) than most other genotypes but a similar commencement of senescence period, lengthening the active growing period (through deferment of commencement of senescence through nitrogen management) could increase total yield. This genotype would be suited to late season growing areas.
3. **FRSST02-03** would be suited to short season growing areas given its' relatively fast rate of plant emergence, tuber initiation, canopy development and short maturity period.
4. Manipulation of commencement of senescence through nitrogen management would potentially increase total yield for all evaluated genotypes.

Discussion

Seven genotypes from the Stage 1 trial were selected, by Simplot representatives and researchers, as being worthy of further evaluation in future work. At the time of this report, a decision is still pending on what Simplot Australia intend to do with these genotypes.

Four genotypes from the Stage 2 trial displayed enough potential to warrant further investigation. Two of these cultivars have been tested and released into the Tasmanian Certified Seed Potato scheme for multiplication prior to intense agronomy profiling work starting in 2008-09. The remaining two lines have begun the process of reintroduction into the Tasmanian Certified Seed Potato Scheme but given the various testing procedures involved, it is unlikely that these cultivars will be available for further semi-commercial testing by Simplot Australia prior to 2009-2010.

Technology transfer

Due to the commercial in confidence nature of this project, dissemination of results is limited to Simplot Australia personnel only. A general overview of the project aims is presented at the annual FRS Open Day.

Conclusions

The comparative evaluation of new potato genotypes reported here continues to be a major part of the ongoing development of the Tasmanian potato industry and, beyond that, a contribution to the Australian Processing Potato Improvement Program. The latter is a significant part of Horticulture Australia Limited's research and development portfolio for the potato industry.

Approximately forty percent of all lines evaluated in these trials were retained for their superior attributes in relation to the industry standard Russet Burbank. Simplot Australia consider this a positive outcome for the project.

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Table 1.

Cultivar	Spacing in rows cm	Yield and Numbers														Rank by Fry Grade	Tuber No. Per Plant
		Chats 0-80g		Small 80-250g		Mid 250-650g		Large 650-850g		Over >850g		Frygrade >80g t/ha	Total Yield t/ha	80 - 650g Yield t/ha	% of Fry Grade Wt. >250g	Waste Yield t/ha	
		No./m2	t/ha	No./m2	t/ha	No./m2	t/ha	No./m2	t/ha	No./m2	t/ha						
FRSST2-01	**29**	4.2	2.1	14.3	24.5	12.8	47.9	0.5	3.7	0.0	0.0	76.1	78.4	72.5	67.5	0.1	1	7.6
RB Ruen	**32**	9.1	4.4	30.3	46.7	6.0	18.4	0.0	0.0	0.0	0.0	65.1	74.1	65.1	27.6	4.5	6	11.8
FRSST2-02	**26**	2.9	1.5	9.4	18.3	12.6	46.9	0.4	2.9	0.3	3.6	71.7	73.8	65.2	74.3	0.6	2	5.6
FRSST2-03	**29**	5.7	3.1	26.0	41.9	8.3	25.2	0.04	0.3	0.04	0.4	67.8	71.5	67.1	38.4	0.6	3	9.5
Ranger	**26**	7.3	3.8	23.0	38.3	8.6	27.2	0.04	0.3	0.0	0.0	65.8	70.7	65.5	41.6	1.1	5	8.3
Shepody	**20**	2.5	1.2	12.6	20.5	12.1	43.9	0.3	2.4	0.0	0.0	66.8	68.3	64.4	69.1	0.3	4	4.8
FRSST2-04	**29**	3.3	1.7	15.7	26.8	10.7	35.0	0.0	0.0	0.0	0.0	61.8	65.9	61.8	56.7	2.4	7	7.3
LSD P = 0.05		3.3	1.6	4.8	7.2	3.3	11.8	0.2	1.6	0.1	0.9	ns	ns	ns	12.4	2.6		1.2
LSD P = 0.01		4.6	2.2	6.8	10.0	4.6	16.6	0.3	2.3	0.1	1.3	ns	ns	ns	17.4	ns		1.7

Key : **ns = not significant**
nr = not recorded
na = not applicable

Table 2.

Cultivar	Spacing in rows cm	Yield and Numbers															Rank by Fry Grade	Tuber No. Per Plant
		Chats 0-80g		Small 80-200g		Mid 200-400g		Large 400-600g		Over 600-850g		Frygrade >80g t/ha	Total Yield t/ha	80 – 600g Yield t/ha	% of Fry Grade Wt. >200g	Waste Yield t/ha		
		No./m2	t/ha	No./m2	t/ha	No./m2	t/ha	No./m2	t/ha	No./m2	t/ha							
FRSST2-05	**26**	3.5	1.5	15.0	21.3	15.9	43.6	2.8	13.0	0.2	1.2	79.0	81.1	77.9	72.9	0.7	1	11.0
FRSST2-06	**26**	8.5	3.9	21.8	29.9	13.9	36.8	1.3	6.2	0.1	0.9	73.8	79.4	72.9	59.3	1.7	2	5.5
LSD P = 0.05		4.4	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns		5.2
LSD P = 0.01		ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns		ns

Key : **ns = not significant**
nr = not recorded
na = not applicable

Nb. no tubers >850g

Table 3.

Cultivar	Spacing in rows	Yield and Numbers														Rank by Fry	Tuber No. Per Plant
		Chats 0-40mm		Small 40-60mm		Mid 60-80mm		Large 80-100mm		Over >100mm		Frygrade >40mm	Total Yield	% of Fry Grade Wt.	Waste Yield		
	cm	No./m2	t/ha	No./m2	t/ha	No./m2	t/ha	No./m2	t/ha	No./m2	t/ha	t/ha	t/ha	>80mm	t/ha	Grade	Plant
FRSST2-07	**26**	16.9	5.6	41.0	31.6	16.7	23.7	0.04	0.1	0.0	0.0	55.4	61.2	0.2	0.3	1	16.1
LSD P = 0.05		na	na	na	na	na	na	na	na	na	na	na	na	na	na		na
LSD P = 0.01		na	na	na	na	na	na	na	na	na	na	na	na	na	na		na

Key : **ns = not significant**
nr = not recorded
na = not applicable

Table 4.

Cultivar	Days to Maturity	Powdery Scab Rating	Quality														Internal Defects (percentage of sample)					
			Bruise Ratings			Specific	% Dry	Fry Assessment								Uncooked	1st 10	1st 10	1st 10	2nd 10	2nd 10	2nd 10
			Stem end	Rose end	Shatter	Gravity	Matter	%000	%00	%0	%1	%2	%3	%4	Dark End %	Flesh Colour	Hollow	Brown Centre	Total	Hollow	Brown Centre	Total
FRSST2-07	131.0	0.0	5.4	4.3	0.0	1.092	22.5	0.0	100.0	0.0	0	0	0	0	0.0	3	3.3	0.0	3.3	0.0	0.0	0.0
FRSST2-06	150.0	1.0	1.1	1.1	0.7	1.086	21.4	43.3	56.7	0.0	0	0	0	0	0.0	1	13.3	0.0	13.3	0.0	0.0	0.0
FRSST2-05	143.0	1.7	2.6	2.6	0.7	1.083	20.8	0.0	100.0	0.0	0	0	0	0	0.0	4	0.0	0.0	0.0	0.0	0.0	0.0
FRSST2-04	131.0	0.0	4.4	3.3	0.7	1.088	21.7	33.3	66.7	0.0	0	0	0	0	3.3	1	0.0	0.0	0.0	0.0	0.0	0.0
FRSST2-02	154.0	1.0	2.9	2.2	0.3	1.088	21.8	16.7	75.9	7.4	0	0	0	0	0.0	2	10.0	3.3	13.3	0.0	0.0	0.0
FRSST2-01	136.3	0.0	2.0	1.4	0.0	1.084	21.0	100.0	0.0	0.0	0	0	0	0	0.0	1	13.3	0.0	13.3	0.0	0.0	0.0
Ranger	136.3	0.3	6.1	5.2	1.0	1.095	23.2	0.0	0.0	100.0	0	0	0	0	3.3	1	0.0	0.0	0.0	0.0	0.0	0.0
RB Ruen	133.7	0.0	5.1	3.8	0.7	1.090	22.2	43.3	56.7	0.0	0	0	0	0	0.0	1	10.0	20.0	30.0	0.0	3.3	3.3
Shepody	131.0	3.7	2.6	2.1	1.3	1.086	21.4	20.0	76.7	3.3	0	0	0	0	26.7	1	0.0	3.3	3.3	0.0	0.0	0.0
FRSST2-03	128.0	0.0	2.8	2.6	0.3	1.088	21.8	0.0	100.0	0.0	0	0	0	0	0.0	1	0.0	0.0	0.0	0.0	0.0	0.0
LSD P=0.05	5.1	0.6	1.2	0.9	ns	0.005	1.0	48.8	49.1	7.3	na	na	na	na	9.2	na	10.9	6.8	12.3	na	ns	ns
LSD P=0.01	7.0	0.8	1.6	1.2	ns	0.007	1.4	66.8	67.2	10.0	na	na	na	na	12.6	na	ns	9.4	16.9	na	ns	ns

Key : **ns = not significant** **nr = not recorded** **na = not applicable**

Table 5.

Cultivar	Rep	Skin Colour	Skin Texture	Primary Shape	Secondary Shapes	Eye Depth	Heel Depth	Distortion	Size	Size Uniformity	Harvest Comments
FRSST2-07	**1**	w	2.5	7	-	sh	med	nil	sm	2.5	very uniform
FRSST2-07	**2**	w	2.5	7	-	sh	med	nil	sm	2.5	lot of tubers, fairly uniform
FRSST2-07	**3**	w	2.5	7	-	sh	med	nil	sm/med	2	less size uniformity than rep 2
FRSST2-06	**1**	w	3	6	4 7 odd 8	sh	sh	vsl	med	2	scab?, slight black scurf
FRSST2-06	**2**	w	3	6	4 7 odd 8	sh	sh	vsl	med	2	no cracks, no black scurf
FRSST2-06	**3**	w	3	6	2 4 7 odd 8	sh	sh	sl	med/lg	2.5	odd crack, scab?, slight black scurf
FRSST2-05	**1**	y	2.5	6	2 4 odd 8	sh	sh	vsl	vlg	2.5	scab, odd mishape, too large for wedge?
FRSST2-05	**2**	y	2.5	8	6 odd 8	sh	sh	vsl	lg	2.5	scab, odd mishape, too large for wedge?
FRSST2-05	**3**	y	2.5	6	2 4 odd 8	sh	sh	vsl	vlg	2.5	
FRSST2-04	**1**	w	3	2	6 4 odd 8	sh	sh	sl	med/lg	2.5	odd mishape & crack
FRSST2-04	**2**	w	3	2	6 4	sh	sh	vsl	med/lg	2.5	odd crack, good shape & size uniformity
FRSST2-04	**3**	w	3	6	2 4	sh	sh	sl	med	2	odd crack & mishape, not as large & uniform as rep 2
FRSST2-02	**1**	w	3	2	3 4 5	sh	sh	sl	vvlg	2.5	long & thin, large are lumpy, scab? eyebrows - too much N?
FRSST2-02	**2**	w	3	2	3 4 5	sh	sh	sl	vvlg	2.5	long & thin, large are lumpy, scab? eyebrows - too much N?
FRSST2-02	**3**	w	3	2	3 4 5	sh	sh	sl	vvlg	2.5	long & thin, large are lumpy, scab? eyebrows - too much N?
FRSST2-01	**1**	w	3	2	4 odd 6 & 8	sh	sh	vsl	vlg	2	larger & more blocky than rep 2
FRSST2-01	**2**	w	3	2	6 4 odd 8	sh	sh	vsl	lg	2	roundish?
FRSST2-01	**3**	w	3	2	6 4 odd 8	sh	sh	vsl	lg	2	larger & more blocky than rep 2
Ranger	**1**	w	3	6	2 4 odd 7 & 8	sh	sh	sl	med/lg	2	more mishapes than rep 3
Ranger	**2**	w	3	6	2 4 odd 7 & 8	sh	sh	sl	med/lg	2	mishapes, uneven size, odd crack
Ranger	**3**	w	3	6	2 4 odd 7 & 8	sh	sh	vsl	med	2.5	odd mishape, good size uniformity
RB Ruen	**1**	w	3	6	2 8 4 odd 7	med	sh	mod	med/lg	2	mishapes & cracks
RB Ruen	**2**	w	3	6	2 4 odd 7 & 8	med	sh	vsl	med	2.5	odd crack, smaller & more uniform than rep 1
RB Ruen	**3**	w	3	6	2 4 3	med	sh	sl	sm/med	2.5	very small for RB, no cracks
Shepody	**1**	w	2	8	2 6 7	sh	sh	sl	lg	2	lumpy, ugly, pear shaped, scab!
Shepody	**2**	w	2	8	2 6 7	sh	sh	vsl	lg	2.5	pears & scab, odd mishape, uniform size
Shepody	**3**	w	2	8	2 6 7	sh	sh	sl	lg/vlg	2	lumpy, ugly, pear shaped, scab!
FRSST2-03	**1**	w	3	3	6 2 4 8 9	sh	sh	vsl	med	2	slightly pointy tubers
FRSST2-03	**2**	w	3	3	6 2 4 8 9	sh	sh	vsl	med/lg	2	larger sample than other reps
FRSST2-03	**3**	w	3	3	6 2 4 8 9	sh	sh	vsl	med/lg	1.5	too pointy & poor size uniformity?

Table 5. cont

Cultivar	Rep	Grading Comment	Fry Comment	Bruise Comment	Flower Colour	Emergence & Flower Comment
FRSST2-07	**1**		golden fry colour		white	
FRSST2-07	**2**		golden fry colour		white	
FRSST2-07	**3**		golden fry colour		white	
FRSST2-06	**1**				mauve	
FRSST2-06	**2**		vsl vasc ring		mauve	
FRSST2-06	**3**		vsl vasc ring		mauve	
FRSST2-05	**1**		vsl vasc ring, golden fry colour		white	
FRSST2-05	**2**		vsl vasc ring, golden fry colour		white	
FRSST2-05	**3**		golden fry colour		white	
FRSST2-04	**1**				purple	
FRSST2-04	**2**		vsl vasc ring	slight pale spot	purple	
FRSST2-04	**3**				purple	
FRSST2-02	**1**		vsl vasc ring		white	
FRSST2-02	**2**			slight pale spot	white	
FRSST2-02	**3**		vsl vasc ring	pale spot	white	
FRSST2-01	**1**		slight vasc ring		white	
FRSST2-01	**2**		vsl vasc ring		white	
FRSST2-01	**3**		vsl vasc ring		white	
Ranger	**1**		vsl vasc ring		purple	
Ranger	**2**		mod vasc ring		purple	
Ranger	**3**		vsl vasc ring		purple	
RB Ruen	**1**		vsl vasc ring		white	
RB Ruen	**2**		vsl vasc ring		white	
RB Ruen	**3**		vasc ring		white	
Shepody	**1**		sl vasc ring		pink/mauve	
Shepody	**2**		vsl vasc ring		pink/mauve	
Shepody	**3**		sl vasc ring		pink/mauve	
FRSST2-03	**1**		vsl mottling		mauve	
FRSST2-03	**2**			pale spot	mauve	
FRSST2-03	**3**		vsl vr	pale spot	mauve	

Key : see Appendix A

Table 6.

Cultivar	Spacing in rows	Yield and Numbers														Rank by Fry	Tuber No. Per
		Chats 0-80g		Small 80-250g		Mid 250-650g		Large 650-850g		Over >850g		Frygrade >80g	Total Yield	80 - 650g Yield	% of Fry Grade Wt.	Waste Yield	
	cm	No./m2	t/ha	No./m2	t/ha	No./m2	t/ha	No./m2	t/ha	No./m2	t/ha	t/ha	t/ha	t/ha	>250g	t/ha	Grade	Plant
FRSST1-01	**27.5**	13.8	7.1	41.9	64.7	7.2	23.7	0.0	0.0	0.0	0.0	88.4	96.2	88.4	26.4	0.7	1	14.4
FRSST1-02	**25**	12.6	5.5	24.3	38.2	13.2	46.7	0.1	0.9	0.0	0.0	85.7	92.5	84.8	55.4	1.2	2	10.4
FRSST1-03	**25**	3.6	1.9	18.3	31.2	14.2	49.2	0.7	4.6	0.04	0.4	85.4	87.8	80.4	63.4	0.6	3	7.6
FRSST1-04	**25**	5.9	2.6	31.2	52.6	8.6	26.2	0.0	0.0	0.0	0.0	78.8	81.6	78.8	33.2	0.2	4	9.3
FRSST1-05	**25**	8.5	4.5	41.7	64.1	4.1	12.0	0.0	0.0	0.0	0.0	76.1	81.5	76.1	15.8	0.9	5	11.3
Ranger	**25**	7.0	3.7	25.8	47.6	6.1	18.7	0.04	0.3	0.0	0.0	66.6	71.4	66.3	28.6	1.2	7	8.0
FRSST1-06	**25**	5.8	3.2	25.3	41.0	7.9	25.4	0.1	0.9	0.0	0.0	67.3	71.4	66.4	38.5	0.9	6	8.2
FRSST1-07	**25**	19.1	9.5	38.6	53.8	2.1	6.3	0.0	0.0	0.0	0.0	60.1	69.7	60.1	10.4	0.2	12	12.1
FRSST1-08	**22.5**	4.3	2.3	24.5	40.2	7.5	24.0	0.0	0.0	0.0	0.0	64.3	68.6	64.3	36.8	2.1	8	6.8
FRSST1-09	**22.5**	5.7	2.7	19.6	32.3	9.3	31.3	0.0	0.0	0.0	0.0	63.6	67.8	63.6	49.1	1.5	10	6.4
FRSST1-10	**25**	9.3	5.3	37.2	54.0	2.3	6.5	0.0	0.0	0.0	0.0	60.6	66.3	60.6	10.5	0.4	11	9.9
FRSST1-11	**25**	17.8	9.4	36.3	50.6	1.9	5.8	0.0	0.0	0.0	0.0	56.4	65.9	56.4	10.2	0.2	13	11.5
Shepody	**20**	1.7	0.7	12.3	21.9	10.5	38.7	0.5	3.2	0.0	0.0	63.9	65.2	60.6	65.7	0.7	9	4.1
RB Ruen	**32.5**	6.8	3.6	28.9	42.6	3.5	10.6	0.0	0.0	0.0	0.0	53.2	65.1	53.2	19.9	8.3	14	11.3
FRSST1-12	**25**	3.7	1.7	14.1	22.5	8.2	27.3	0.04	0.3	0.0	0.0	50.1	53.6	49.8	54.2	1.8	15	5.5
LSD P = 0.05		3.0	1.8	4.7	4.9	2.4	8.8	0.2	1.4	ns	ns	7.7	7.6	7.6	10.5	2.6		1.3
LSD P = 0.01		4.1	2.4	6.4	6.6	3.2	11.9	0.2	1.8	ns	ns	10.4	10.3	10.3	14.2	3.5		1.7

Key : **ns = not significant**
nr = not recorded
na = not applicable

Table 7.

Cultivar	Spacing in rows cm	Yield and Numbers: Chats 0-80g No./m2	Chats 0-80g t/ha	Small 80-200g No./m2	Small 80-200g t/ha	Mid 200-400g No./m2	Mid 200-400g t/ha	Large 400-600g No./m2	Large 400-600g t/ha	Over 600-850g No./m2	Over 600-850g t/ha	Frygrade >80g t/ha	Total Yield t/ha	80 – 600g Yield t/ha	% of Fry Grade Wt. >200g	Waste Yield t/ha	Rank by Fry Grade	Tuber No. Per Plant
FRSST1-13	**25**	4.9	2.0	14.3	20.6	19.9	57.1	2.8	13.2	0.3	1.9	92.8	99.4	90.9	77.8	4.6	1	8.8
FRSST1-14	**25**	11.9	6.1	35.6	49.7	13.3	33.2	0.1	0.5	0.0	0.0	83.4	89.6	83.4	40.3	0.2	2	12.6
FRSST1-15	**25**	8.6	4.2	26.5	37.4	15.5	40.8	0.5	2.0	0.0	0.0	80.2	84.9	80.2	53.3	0.5	3	10.4
LSD P = 0.05		3.5	2.2	5.3	6.6	4.0	9.5	1.4	5.5	ns	ns	ns	ns	ns	5.0	ns		2.2
LSD P = 0.01		ns	ns	8.7	10.9	ns	15.7	2.3	9.1	ns	ns	ns	ns	ns	8.3	ns		ns

Key : **ns = not significant** **Nb. no tubers >850g**
nr = not recorded
na = not applicable

Table 8.

Cultivar	Spacing in rows cm	Yield and Numbers: Chats 0-40mm No./m2	Chats 0-40mm t/ha	Small 40-60mm No./m2	Small 40-60mm t/ha	Mid 60-80mm No./m2	Mid 60-80mm t/ha	Large 80-100mm No./m2	Large 80-100mm t/ha	Over >100mm No./m2	Over >100mm t/ha	Frygrade >40mm t/ha	Total Yield t/ha	% of Fry Grade Wt. >80mm	Waste Yield t/ha	Rank by Fry Grade	Tuber No. Per Plant
FRSST1-16	**25**	10.7	2.7	38.8	29.5	31.7	49.9	0.9	2.4	0.0	0.0	81.7	86.7	3.0	2.3	1	17.0
FRSST1-17	**25**	8.1	2.6	56.1	56.4	10.1	19.0	0.2	0.7	0.0	0.0	76.1	79.0	0.9	0.4	2	15.1
FRSST1-18	**22.5**	25.1	7.3	89.3	58.8	5.0	6.4	0.0	0.0	0.0	0.0	65.2	72.8	0.0	0.3	3	22.1
FRSST1-19	**25**	11.7	3.9	51.2	48.5	3.9	7.6	0.0	0.0	0.0	0.0	56.1	60.3	0.0	0.3	4	13.7
LSD P = 0.05		7.3	2.8	14.8	7.0	6.8	9.5	0.4	1.4	na	na	7.9	8.1	1.9	ns		2.1
LSD P = 0.01		11.0	ns	22.4	10.6	10.3	14.5	0.7	ns	na	na	12.0	12.3	ns	ns		3.2

Key : **ns = not significant**
nr = not recorded
na = not applicable

Table 9.

Cultivar	Days to Maturity	Powdery Scab Rating	Quality														Internal Defects (percentage of sample)					
			Bruise Ratings			Specific	% Dry	Fry Assessment								Uncooked	1st 10	1st 10	1st 10	2nd 10	2nd 10	2nd 10
			Stem end	Rose end	Shatter	Gravity	Matter	%000	%00	%0	%1	%2	%3	%4	Dark End %	Flesh Colour	Hollow	Brown Centre	Total	Hollow	Brown Centre	Total
FRSST1-19	130.0	0.0	1.4	0.9	0.0	1.089	22.0	66.7	33.3	0.0	0.0	0.0	0.0	0.0	0.0	1.3	0	0	0	0	0	0
FRSST1-02	165.0	2.3	2.0	2.0	0.3	1.093	22.9	0.0	30.0	70.0	0.0	0.0	0.0	0.0	0.0	1.0	3	0	3	0	0	0
FRSST1-10	121.0	3.7	2.6	2.8	1.7	1.080	20.1	33.3	66.7	0.0	0.0	0.0	0.0	0.0	3.3	1.7	0	0	0	0	0	0
FRSST1-11	121.0	0.0	3.5	3.4	1.0	1.089	21.9	0.0	48.1	51.9	0.0	0.0	0.0	0.0	0.0	1.0	0	0	0	0	0	0
FRSST1-06	138.0	0.0	4.8	5.5	2.0	1.092	22.5	0.0	100.0	0.0	0.0	0.0	0.0	0.0	0.0	1.0	0	0	0	0	0	0
FRSST1-09	138.0	0.3	1.6	3.1	1.0	1.093	22.9	90.0	10.0	0.0	0.0	0.0	0.0	0.0	0.0	1.0	0	0	0	0	0	0
FRSST1-08	121.0	0.0	2.7	3.4	1.3	1.090	22.2	26.7	50.0	23.3	0.0	0.0	0.0	0.0	0.0	1.0	0	0	0	0	0	0
FRSST1-12	130.0	0.0	6.0	4.1	3.0	1.095	23.2	0.0	83.3	16.7	0.0	0.0	0.0	0.0	0.0	4.0	0	0	0	0	0	0
FRSST1-13	144.0	1.0	4.2	2.2	0.0	1.089	21.9	30.0	70.0	0.0	0.0	0.0	0.0	0.0	0.0	2.0	0	7	7	0	0	0
FRSST1-01	158.0	3.7	0.9	0.3	0.0	1.089	22.0	0.0	66.7	33.3	0.0	0.0	0.0	0.0	0.0	5.0	0	0	0	0	0	0
FRSST1-15	153.0	0.0	0.6	0.6	0.0	1.092	22.7	0.0	100.0	0.0	0.0	0.0	0.0	0.0	0.0	4.7	3	0	3	0	0	0
FRSST1-04	158.0	1.3	4.2	2.8	1.0	1.088	21.8	3.3	96.7	0.0	0.0	0.0	0.0	0.0	3.3	1.3	0	0	0	0	0	0
FRSST1-03	144.0	2.3	5.5	5.4	3.0	1.085	21.2	0.0	36.7	60.0	3.3	0.0	0.0	0.0	3.3	1.0	3	0	3	0	0	0
FRSST1-07	130.0	0.7	6.6	6.6	3.0	1.078	19.7	0.0	70.0	26.7	3.3	0.0	0.0	0.0	3.3	1.7	0	13	13	0	3	3
FRSST1-14	144.0	0.7	2.9	3.1	0.0	1.086	21.4	0.0	76.7	23.3	0.0	0.0	0.0	0.0	3.3	1.0	0	0	0	0	0	0
FRSST1-05	144.0	0.3	1.6	2.6	0.0	1.092	22.7	66.7	33.3	0.0	0.0	0.0	0.0	0.0	46.7	1.0	0	0	0	0	0	0
FRSST1-17	149.0	1.7	6.4	5.5	1.0	1.109	26.1	100.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.0	0	0	0	0	0	0
FRSST1-16	149.0	0.7	3.8	2.5	0.7	1.097	23.7	0.0	100.0	0.0	0.0	0.0	0.0	0.0	6.7	2.0	0	0	0	0	0	0
Ranger	138.0	0.0	5.9	4.4	0.0	1.089	22.0	0.0	3.3	96.7	0.0	0.0	0.0	0.0	3.3	2.0	0	0	0	0	0	0
RB Ruen	130.0	0.0	3.8	3.6	1.0	1.088	21.8	63.3	36.7	0.0	0.0	0.0	0.0	0.0	6.7	1.0	10	30	40	3	20	23
Shepody	130.0	3.0	1.2	1.1	0.0	1.085	21.1	0.0	80.0	20.0	0.0	0.0	0.0	0.0	10.0	1.0	0	3	3	0	0	0
FRSST1-18	121.0	3.3	4.1	2.0	0.3	1.090	22.3	100.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.0	0	0	0	0	0	0
LSD P=0.05	na	0.9	1.7	1.8	1.0	0.004	0.7	44.8	57.3	38.4	ns	na	na	na	10.7	0.5	ns	8	8	ns	4	4
LSD P=0.01	na	1.2	2.2	2.3	1.3	0.005	1.0	59.9	76.6	51.4	ns	na	na	na	14.3	0.6	ns	11	10	ns	5	6

Key : **ns = not significant** **nr = not recorded** **na = not applicable**

Table 10.

Cultivar	Rep	Skin Colour	Skin Texture	Primary Shape	Secondary Shapes	Eye Depth	Heel Depth	Distortion	Size	Size Uniformity	Harvest Comments
FRSST1-19	**1**	w	2	4	5	sh	sh	nil	sm	3	lot of small tubers (marbles)
FRSST1-19	**2**	w	2.5	4	5 7 8	sh	sh	vsl	sm	3	as for rep 1
FRSST1-19	**3**	w	2.5	4	5 7 6	sh	sh	vsl	sm	3	lot of tubers, too small (marbles)
FRSST1-02	**1**	w	3	2	6 4 odd 8	sh	sh	sl	lg	2	large are lumpy, slight eyebrows, scab
FRSST1-02	**2**	w	2.5/3	2	4 6	sh	sh	vsl	lg	2	scab, better size uniformity than rep 3
FRSST1-02	**3**	w	3	6	2 4	sh	sh	vsl	lg	1.5	large are slightly lumpy, size variation, scab
FRSST1-10	**1**	w	2	3	5 4 odd 8	sh	sh	sl	sm/med	2.5	scab!, too small? & thin
FRSST1-10	**2**	w	2	3	5 4 odd 8	sh	sh	vsl	sm/med	2.5	scab!, too small? & thin
FRSST1-10	**3**	w	2	3	5 4 odd 8	sh	sh	vsl	sm/med	2.5	scab!, too small? & thin
FRSST1-11	**1**	w	2	4	5 3 odd 8	sh	sh	vsl	sm/med	2	small tubers, no bulk
FRSST1-11	**2**	w	2	4	5 3 odd 8	sh	sh	vsl	sm/med	2	small tubers, no bulk
FRSST1-11	**3**	w	2	4	5 3 odd 8	sh	sh	vsl	sm/med	2	small tubers, no bulk
FRSST1-06	**1**	w	3	2	4 6 5 odd 8	sh	sh	vsl	med/lg	2	size & shape variation, needs to be bigger
FRSST1-06	**2**	w	3	2	6 4	sh	sh	vsl	med/lg	2	odd mishape
FRSST1-06	**3**	w	3	2	6 4 8 9	sh	sh	vsl	med/lg	2	pointy, shape variation, odd mishape
FRSST1-09	**1**	w	3	6	8 2 4 7	sh	sh	vsl	med/lg	1.5	size uniformity?, shape variation, cracks
FRSST1-09	**2**	w	3	6	4 2	sh	sh	vsl	med/lg	2.5	odd crack
FRSST1-09	**3**	w	3	2	6 4 8	sh	sh	vsl	lg	2	cracks, flattish tubers, odd mishape
FRSST1-08	**1**	w	2.5	4	5 3 6 8	sh	sh	sl	med	2	too thin, odd mishape, shape variation
FRSST1-08	**2**	w	2.5	4	5 3 6 8	sh	sh	sl	med	2	too thin, odd mishape, shape variation
FRSST1-08	**3**	w	2.5	8	6 odd 7, 4 & 5	sh	sh	sl	med	2	pears, odd mishape, variable shape
FRSST1-12	**1**	y	2	2	4 3 8	sh	sh	sl	med/lg	1.5	odd crack, smaller than rep 3
FRSST1-12	**2**	y	2	2	4 6 odd 8	sh	sh	vsl	lg	2	large sample, odd mishape
FRSST1-12	**3**	y	2	2	4 6 odd 8	sh	sh	sl	lg	2	odd crack & mishape
FRSST1-13	**1**	w	2.5	7	6 odd 8	med	med	vsl	lg	2.5	large round even tubers, slight eyebrows, kennebec type
FRSST1-13	**2**	w	2	7	odd 6	med	sh	vsl	lg	2.5	even large sample, odd large are lumpy
FRSST1-13	**3**	w	2.5	7	odd 6	med	med	vsl	lg	2.5	Kennebec type, cracks
FRSST1-01	**1**	y	2	6	2 4 8 10 7	sh	sh	vsl	sm/med	2	variable shape, scab!
FRSST1-01	**2**	y	2	6	2 4 8	sh	sh	vsl	med	2	variable shape, scab, larger sample than rep 1
FRSST1-01	**3**	y	2.5	4	6 2 8	sh	sh	sl	med	2.5	scab!, thinnish tubers
FRSST1-15	**1**	y	2	6	7 4 3	sh	sh	vsl	med/lg	2	variable shape
FRSST1-15	**2**	y	2	6	7 4 3	sh	sh	vsl	med/lg	2	variable shape
FRSST1-15	**3**	y	2.5	6	4 odd 7 & 8	sh	sh	vsl	med/lg	2.5	variable shape

Table 10 cont.

Cultivar	Rep	Skin Colour	Skin Texture	Primary Shape	Secondary Shapes	Eye Depth	Heel Depth	Distortion	Size	Size Uniformity	Harvest Comments
FRSST1-04	**1**	w	3	6	2 4 odd 8	med	sh	vsl	med/lg	2	slight eyebrows, fairly uniform size & size
FRSST1-04	**2**	w	3	6	2 4 odd 8	sh	sh	nil	med/lg	2.5	good shape & size uniformity
FRSST1-04	**3**	w	3	6	2 4 odd 8	sh	sh	vsl	med/lg	2.5	odd crack, good shape & size uniformity
FRSST1-03	**1**	w	2	6	2 4 5	sh	sh	sl	v lg	2	less pointy than rep 3, odd mishape
FRSST1-03	**2**	w	2	8	9 2 6	sh	sh	sl	lg	2	scab, pointy, odd mishape
FRSST1-03	**3**	w	2.5	8	9 6 4 2 3	sh	sh	sl/mod	lg	2.5	too pointy, shape variation, mishapes
FRSST1-07	**1**	w	2.5	5	4 odd 8, 9 & 10	sh	sh	vsl	sm	3	too small & pointy, variable shape
FRSST1-07	**2**	w	2	9	8 3 4 5	sh	sh	vsl	sm/med	2.5	too pointy & thin, poor shape
FRSST1-07	**3**	w	2.5	5	4 odd 8, 9 & 10	sh	sh	vsl	sm	3	too small & pointy, variable shape
FRSST1-14	**1**	w	3	7	6 8	sh	sh	vsl	lg	2.5	large round even sample, trace common scab
FRSST1-14	**2**	w	3	7	6 8	sh	sh	vsl	lg	2.5	even shape & size, trace common scab
FRSST1-14	**3**	w	3	7	odd 6 & 4	sh	sh	vsl	lg	2.5	good even sample, trace common scab
FRSST1-05	**1**	w	3	8	9 6 odd 7	sh	sh	vsl	sm/med	2.5	small & pointy
FRSST1-05	**2**	w	3	8	4 7 odd 6	sh	sh	vsl	sm/med	2.5	pears!, too small?
FRSST1-05	**3**	w	3	8	6 9 odd 7	sh	sh	vsl	sm/med	2.5	too small? & pointy
FRSST1-17	**1**	y	2.5	4	5 8 7	sh	sh	vsl	sm	3	very even but small, scab?
FRSST1-17	**2**	y	2.5	7	6 8 4	sh	sh	nil	sm	2.5	too small?, lot of tubers
FRSST1-17	**3**	y	2.5	7	6 8 4	sh	sh	nil	sm	2.5	very even but small, scab?
FRSST1-16	**1**	w	2	7	-	sh	sh	vsl	sm/med	2.5	lot of tubers, even sample
FRSST1-16	**2**	w	2	7	odd 6 & 8	sh	med	sl	sm/med	2.5	slight distorts, slight shape variation, lot of tubers
FRSST1-16	**3**	w	2	7	-	sh	med	sl	sm/med	2.5	lot of tubers, even sample
Ranger	**1**	w	3	6	2 4 odd 7 & 8	med	sh	sl	sm/med	2	small sample, some mishapes/distorts
Ranger	**2**	w	3	2	6 4 odd 7 & 8	med	sh	vsl	med	1.5	size variation, smallish, odd mishape
Ranger	**3**	w	3	2	6 odd 8	sh/med	sh	vsl	med	1.5	odd mishape, size variation
RB Ruen	**1**	w	3	6	4 2 8 odd 7	med	sh	sl/mod	med	2.5	small sample, cracking
RB Ruen	**2**	w	3	6	4 2 8 odd 7	med	sh	sl/mod	med	2.5	small sample, cracking
RB Ruen	**3**	w	3	4	6 8 7	med	sh	mod	sm/med	2.5	rhizoctonia, cracks, small sample!
Shepody	**1**	w	2	8	2 6 odd 7	sh	sh	sl	v lg	1.5	odd mishape, scab, very large tubers, poor size uniformity
Shepody	**2**	w	2	8	2 7 4 6	sh	sh	sl	v lg	1.5	odd mishape, scab, very large tubers, poor size uniformity
Shepody	**3**	w	2	8	2 7 4 6	sh	sh	sl	v lg	1.5	odd mishape, scab, very large tubers, poor size uniformity
FRSST1-18	**1**	w	3	7	odd 6	sh	med	vsl	sm	2.5	scab!, too small?, very high tuber set
FRSST1-18	**2**	w	2.5	7	-	sh	sh	nil	sm	3	scab!, too small?, very high tuber set
FRSST1-18	**3**	w	2.5	7	-	sh	sh	nil	sm	3	scab!, too small?, very high tuber set

Table 10 cont.

Cultivar	Rep	Grading Comment	Fry Comment	Bruise Comment	Flower Colour	Emergence & Flower Comment
FRSST1-19	**1**				mauve	
FRSST1-19	**2**				mauve	
FRSST1-19	**3**		slight vasc ring		mauve	
FRSST1-02	**1**		slight vasc ring		white	
FRSST1-02	**2**		slight vasc ring		white	
FRSST1-02	**3**		slight vasc ring		white	
FRSST1-10	**1**				purple	
FRSST1-10	**2**				purple	
FRSST1-10	**3**				purple	
FRSST1-11	**1**				purple	
FRSST1-11	**2**				purple	
FRSST1-11	**3**				purple	
FRSST1-06	**1**				white	
FRSST1-06	**2**				white	
FRSST1-06	**3**				white	
FRSST1-09	**1**		slight vasc ring		white	
FRSST1-09	**2**		slight vasc ring		white	
FRSST1-09	**3**		slight vasc ring		white	
FRSST1-08	**1**				white	
FRSST1-08	**2**		trace vasc ring		white	
FRSST1-08	**3**				white	
FRSST1-12	**1**	yellow pith	golden fry colour		white	
FRSST1-12	**2**	yellow pith	golden fry colour		white	
FRSST1-12	**3**	yellow pith	golden fry colour		white	
FRSST1-13	**1**		slight vasc ring	pale spot	white	
FRSST1-13	**2**		trace vasc ring	pale spot	white	
FRSST1-13	**3**		trace vasc ring	pale spot	white	
FRSST1-01	**1**	yellow pith	moderate vasc ring, golden fry colour		white	
FRSST1-01	**2**	yellow pith	slight vasc ring, golden fry colour		white	
FRSST1-01	**3**	yellow pith	slight vasc ring, golden fry colour		white	
FRSST1-15	**1**	yellow pith	pale golden fry colour		white	
FRSST1-15	**2**	yellow pith	pale golden fry colour		white	
FRSST1-15	**3**	yellow pith	pale golden fry colour		white	

Table 10 cont.

Cultivar	Rep	Grading Comment	Fry Comment	Bruise Comment	Flower Colour	Emergence & Flower Comment
FRSST1-04	**1**		slight vasc ring		mauve	
FRSST1-04	**2**		trace vasc ring		mauve	
FRSST1-04	**3**		slight vasc ring		mauve	
FRSST1-03	**1**				blue	
FRSST1-03	**2**		trace vasc ring		blue	
FRSST1-03	**3**		trace vasc ring		blue	
FRSST1-07	**1**				dehisced	
FRSST1-07	**2**				dehisced	
FRSST1-07	**3**				dehisced	
FRSST1-14	**1**		slight vasc ring		white	
FRSST1-14	**2**		slight vasc ring		white	
FRSST1-14	**3**		slight vasc ring		white	
FRSST1-05	**1**				dehisced	
FRSST1-05	**2**				dehisced	
FRSST1-05	**3**		trace vasc ring		dehisced	
FRSST1-17	**1**				purple	
FRSST1-17	**2**				purple	
FRSST1-17	**3**				purple	
FRSST1-16	**1**		slight vasc ring		white	
FRSST1-16	**2**		slight vasc ring	pale spot	white	
FRSST1-16	**3**		trace vasc ring		white	
Ranger	**1**		moderate vasc ring		mauve	
Ranger	**2**		moderate vasc ring		mauve	
Ranger	**3**		slight vasc ring		mauve	
RB Ruen	**1**		slight vasc ring		dehisced	
RB Ruen	**2**		1 hollow, slight vasc ring		dehisced	
RB Ruen	**3**		moderate vasc ring		dehisced	
Shepody	**1**		slight vasc ring		mauve	
Shepody	**2**		trace vasc ring		mauve	
Shepody	**3**		slight vasc ring		mauve	
FRSST1-18	**1**		moderate vasc ring		white	
FRSST1-18	**2**		slight vasc ring		white	
FRSST1-18	**3**		slight vasc ring		white	

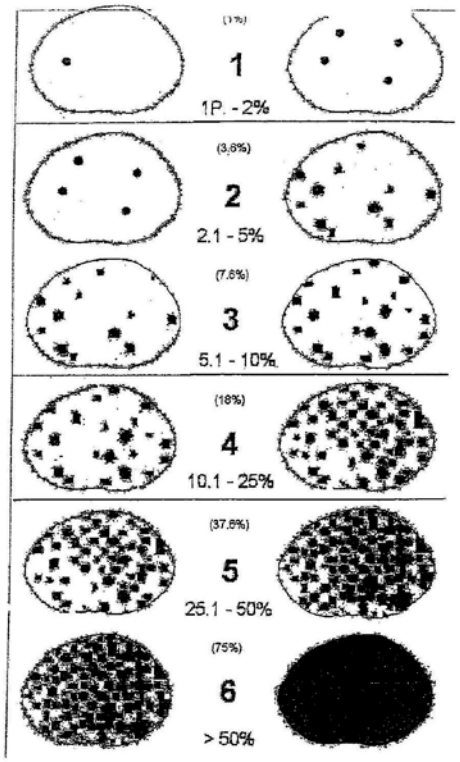
Key : see Appendix A

Appendix A

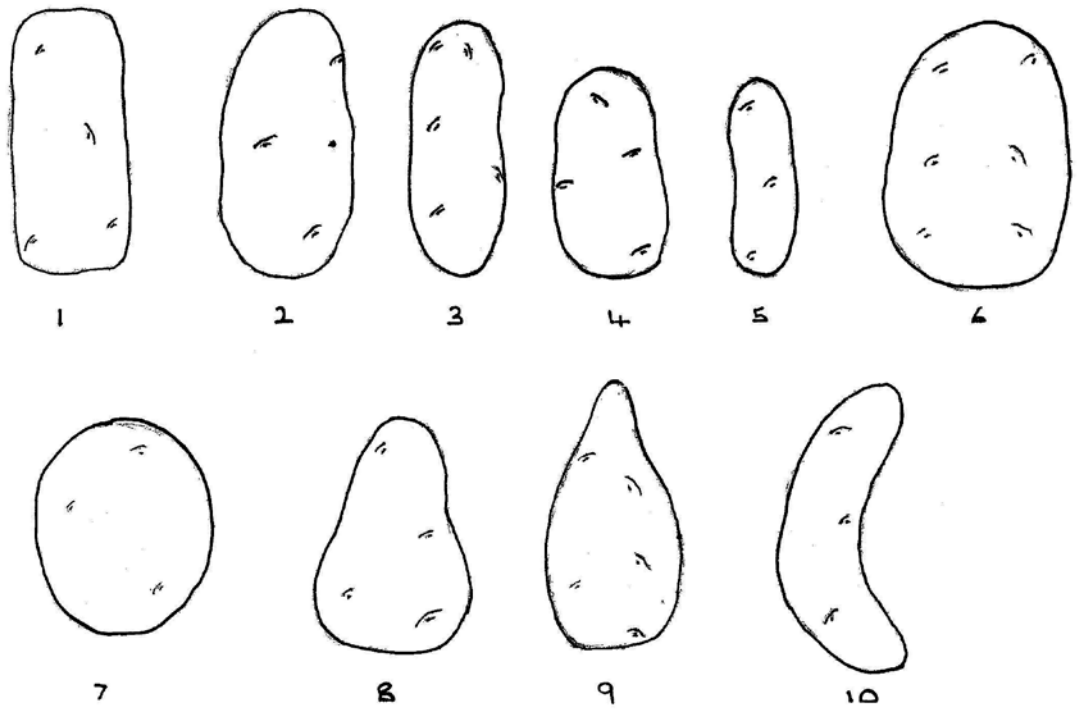
Skin Colour :	w = white	**Size Uniformity :**	1 = poor/uneven
	pb = pink/purple blush		2 = average
	c = cream		3 = good/even
	y = yellow		
Skin Texture :	1 = smooth	**Harvest Comments :**	anything of note
	2 = slight russet		
	3 = heavily russetted	**Grading Comment :**	anything of note
Primary Shape :	as per Appendix B	**Fry Comment :**	anything of note, especially
			yellow fry colour (not easily
Secondary Shapes :	as per Appendix B		expressed with USDA fry chart),
			vascular ring, darker mottling of
Eye & Heel Depth :	sh = shallow		fry strip, etc
	med = medium		
		Bruise Comment :	anything of note
Distortion :	vsl = trace/very slight		
	sl = slight	**Emergence & Flower**	anything of note
	mod = moderate	**Comment :**	
	sev = severe		
Size :	sm = small		
	med = medium		
	lg = large		
	v lg = very large		

Appendix B

Powdery Scab Rating



Tuber Shape



Appendix C

Cultivar	Tuber number per plant	% canopy cover 23 DAP	% canopy cover 25 DAP	% canopy cover 27 DAP	% canopy cover 29 DAP	% canopy cover 31 DAP	% canopy cover 33 DAP	% canopy cover 35 DAP	% canopy cover 37 DAP	% canopy cover 39 DAP	% canopy cover 41 DAP	% canopy cover 43 DAP	% canopy cover 45 DAP	% canopy cover 48 DAP	% canopy cover 52 DAP
FRSST2-07	16.1	2	10	20	25	35	40	60	80	85	95	100			
FRSST2-06	5.5	1	5	10	20	30	35	45	60	70	85	95	97.5	100	
FRSST2-05	11.0	5	20	25	35	40	50	70	85	90	97	100			
FRSST2-04	7.3	1	5	10	15	20	30	40	50	70	80	95	97.5	100	
FRSST2-02	5.6	1	5	10	15	20	25	35	45	60	70	85	90	95	100
FRSST2-01	7.6	1	5	10	20	25	35	50	70	80	90	97.5	100		
Ranger	8.3	3	10	20	30	35	50	70	85	90	95	97.5	100		
RB Ruen	11.8	2	5	15	25	30	40	50	70	80	95	100			
Shepody	4.8	3	5	10	20	25	35	45	60	70	85	97.5	98	100	
FRSST2-03	9.5	5	20	25	35	40	60	75	85	90	97.5	100			
LSD P=0.05	1.4	na	na	na	na	na	na	na	na	na	na	na	na	na	na
LSD P=0.01	2.0	na	na	na	na	na	na	na	na	na	na	na	na	na	na

Cultivar	Days to 100% plant emergence	Days to 50% plant emergence	Frygrade Yield t/ha	Days to tuber initiation	Days to maturity	Commencement of senescence DAP	Stems per plant	Total Yield t/ha
FRSST2-07	25.67	19	55.4	37	131.0	94	3.9	61.2
FRSST2-06	31	21	73.8	37	150.0	115	3.5	79.4
FRSST2-05	30.33	19	79.0	34	143.0	103	2.9	81.1
FRSST2-04	30.33	20.67	61.9	39	131.0	88	2.5	65.9
FRSST2-02	31.67	21.33	71.7	45	154.0	108	2.3	73.8
FRSST2-01	27	21.33	76.1	37	136.3	103	3.0	78.4
Ranger	26.33	19	65.8	37	136.3	103	2.6	70.7
RB Ruen	25.67	19	65.1	34	133.7	108	2.9	74.1
Shepody	31.67	22.33	66.8	37	131.0	94	1.7	68.3
FRSST2-03	29	19	67.8	34	128.0	88	2.7	71.5
LSD P=0.05	4.0	1.3	9.0	na	5.1	na	0.3	8.9
LSD P=0.01	ns	1.8	12.3	na	7.0	na	0.4	12.2

Key : **ns = not significant** **nr = not recorded** **na = not applicable** **DAP = days after planting**