Variety development for the fresh potato market in Western Australia 2005-06

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Department of Agriculture & Food Western Australia

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FINAL REPORT

HORTICULTURE AUSTRALIA LIMITED

PROJECT PT05017

VARIETY DEVELOPMENT FOR THE FRESH POTATO MARKET IN WESTERN AUSTRALIA 2005-06

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Purpose of this Report: To present methods and experimental data used to identify new varieties recommended for commercial testing.

Funding Sources: Department of Agriculture and Food, The Potato Producers Committee of the Agricultural Produce Commission, Horticulture Australia Ltd, AUSVEG individual potato growers and processors who assisted with this project.

Date 24 October 2006

Frontispiece. White Star, a new variety for winter production for Western Australia, was added to the Potato Marketing Corporation of Western Australia's preferred variety list in November 2005. Here a sample from a commercial scale test is displayed in a Perth supermarket. Photograph courtesy of Helen Plange, Potato Marketing Corporation of WA.

Contents PT05017

Media Summary

Key components of project

The project aims to improve productivity of the WA fresh, or ware, potato industry through the development of improved varieties. The varieties are developed by screening, under WA conditions, breeding lines from the Department of Primary Industries, Victorian, Agriculture and Food Potato Breeding Program (DPIVAF-PBP).

Industry significance

Fresh market variety evaluation is a priority of the Australian potato industry and is overseen by the National Evaluation & Commercialisation Committee for the Fresh Potato Breeding Program (FNECC). The WA industry priority we have addressed over the last four years has been the improvement of the performance of winter crops. The yield of these crops is just 60% of the overall average yield for fresh market potatoes in WA. The reduced yield is due to many factors which include storm and wind damage, heavy rain, frost, low temperatures, short days and lack of sunshine. White Star, an improved winter variety identified and developed through this and related projects, can now be considered a commercial variety in WA after its addition to the Potato Marketing Corporation of WA's Preferred Variety List. Therefore the project can now address other issues that can be solved through appropriate variety development. The new challenge will be a variety for summer production to complement the current standard Nadine. This variety will require the cosmetic appeal of Nadine along with its tolerance to blemish diseases and after-cooking-darkening (ACD) but with improved culinary versatility.

Key outcomes

The new fresh market variety, White Star, offers improved pack-out, tuber size, disease tolerance and culinary quality. It is a good example of the benefits improved varieties can provide. White Star has much higher starch level than Nadine and produces a higher yield of large tubers which will help overcome the excess winter production of small potatoes. These improvements benefit farmers and consumers alike. A Benefit Cost Analysis shows a 12.6 benefit cost ratio indicating this, and previous projects, have provided a significant return on investment for the WA potato industry. The analysis showed that the discounted incremental benefit of this project (discounted benefits less discounted costs) over a 15 year period equalled a net present value (NPV) of $3.4 M. This strongly positive NPV indicates that there are net returns to the State from investing in this series of projects.

The advanced breeding lines Auski and Billabong were tested on a commercial scale for the second time. These varieties may offer an alternative to summer production of Delaware with improved appearance over Delaware and superior cooking quality to Nadine. This year's tests showed that Billabong should be tested further while Auski's testing should cease as it was shown to be too susceptible to blemish disease.

Conclusions

Improved potato varieties adapted to local conditions can be produced through this local selection program based on Australian bred potato varieties.

Recommendations for future R&D

Future work should be aimed at developing a variety suitable for the major summer production areas to complement.

Recommendations for practical application to industry

Growers of winter crops on the Swan Coastal Plain should test White Star to see whether our claims of improved yield, pack-out, profits and customer satisfaction hold true under their consitions.

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Technical Summary

Nature of problem

The standard potato varieties grown in WA have faults that limit production and marketing potential. Gains can be made if improved varieties are developed and adopted. We aimed to develop improved varieties for winter fresh market production.

Research undertaken

Breeding lines were obtained from the Department of Primary Industries Victoria, Agriculture and Food's Potato Breeding Program (DPIVAF-PBP) based at Toolangi. These breeding lines were screened in WA in summer and winter. A replicated summer screening was conducted. Winter demonstrations of fresh and crisp varieties were completed. Both a fresh and crisp summer demonstration was also undertaken. Five advanced selections for the fresh market were tested on a commercial scale.

Major findings & industry outcomes

The new fresh market variety, White Star, was added to the preferred variety list of the Potato Marketing Corporation of WA. This gives White Star the industry's imprimatur and means the variety is virtually released. Seed supply is still building but significant quantities will be available for the 2007 season. Seed may be available for interstate sales in 2008. White Star offers improved culinary quality, has much higher starch level than Nadine and produces a higher yield of large tubers which will help overcome the excess winter production of small potatoes. These improvements will benefit farmers and consumers alike. A benefit cost analysis (BCA) showed that, in winter crops, White Star can give an increased gross margin of $10,569/ha compared with Nadine's $6,739/ha. The increased gross margin is due to improved yield and price and reduced seed costs. This BCA shows that over the last four years variety evaluation work in WA had a NPV of $3.4 million with a benefit:cost ration of 12.6. This indicates that the work has been a rewarding investment for the fresh potato industry.

Other advanced breeding lines tested on a commercial scale were: for the fresh domestic market; Auski, Billabong, Michaela, Cherry Red and Flame, while for the fresh crisp export market they were Bliss and Forester.

A comparison of specific gravity (SG) and after-cooking-darkening (ACD) in summer planted plots in WA and Victoria showed that SG was consistently lower in WA while ACD was consistently darker.

Recommendations

- The successful development of White Star means that future variety evaluation work in WA can concentrate on new industry problems that are suitable to resolution through variety development.
- Crosses for this new focus should be planned to provide breeding lines with the characteristics required by the WA potato industry.

Future work

The project advisory committee reviewed the work of the project and recommended that, with the success of White Star for winter production, future work should be aimed at developing a variety suitable for the major summer production areas to complement Nadine. It needs to be high yielding, with versatile culinary qualities with low ACD.

3. Introduction

3.1 Historical Background

This project (PT05017) continues work began in 1989 with HRDC Project PT017 *Potato Variety Evaluation for local, export and processing markets* (Dawson *et al*. 1997). The work continued with Projects PT214, PT515 and PT96017 all entitled *Potato Breeding & cultivar trials in Australia - Western Australia component* (Dawson *et al*. 1998, Dawson & Mortimore 2000). Projects PT214 and PT515 formed part of the National Potato Improvement & Evaluation Scheme (NaPIES) that commenced in 1993. This scheme was based on the Department of Primary Industries, Victoria, Agriculture and Food' Potato Breeding Program (DPIVAF-PBP) with evaluation of breeding lines being carried out in all states. The last three projects finalised were PT00010 *Potato variety evaluation for Western Australia's fresh and export markets* (Dawson & Mortimore 2004a), PT03070 *Variety development for the fresh potato market in Western Australia* (Dawson & Mortimore 2004b) and PT04023 *Variety development for the fresh potato market in Western Australia* (Dawson & Mortimore 2005).

3.2 Significance to Industry

Current varieties do not always meet potato purchasers' specifications, which means the industry does not operate to its full potential. This is a national priority of the fresh potato industry and there is a dedicated body, The National Evaluation & Commercialisation Committee for the Fresh Potato Breeding Program (FNECC 2004) to ensure variety evaluation is carried out efficiently and uniformly. An example showing how current varieties do not meet consumer and grower expectations for the fresh market is given below.

The industry priority we tackled was improved variety performance in winter grown crops. These crops are for September to mid October deliveries and 6,500 tonnes are produced with an average yield of just 26.9 t/ha. The potatoes are freshly harvested from crops planted in April and May. The yield is just 60% of the overall average yield for fresh market potatoes in WA of 44.9 t/ha. It is just 36% of the average yield of the highest yielding times. The reduced yield in for these crops is due to many factors which include storm and wind damage, heavy rain, frost, low temperatures, short days and lack of sunshine. The result is reduced profitability due to small tuber size with many other tubers rendered unmarketable by powdery scab.

If marketable yield can be increased by 5% then, assuming an average return to growers of $500 per tonne, the benefit to growers will be 26.6 t/ha x 5% x $500/tonne x 238 ha = $160,000 per year. The benefits could be expected to accrue over many years during which the variety evaluation project would have moved on to tackle other problems.

Some of these future problems could be the fungal blemish diseases of silver scurf (*Helmithosporium solani*) and black dot (*Colletotrichum coccodes*) that affect the major production areas.

Aim

The project was undertaken to provide superior potato varieties better suited to the requirements of the WA potato industries. In particular we are looking for improvement in winter grown varieties for both the fresh and export crisp markets.

4. Materials & Methods

4.1 Sources of material

Breeding

New varieties were bred by the Department of Primary Industries Victoria, Agriculture and Food's Potato Breeding Program (DPIVAF-PBP) based at Toolangi. Here 25,000 seedlings are produced annually but only 20,000 produce tubers. All 20,000 are field tested as single plants in the first year and about 1,500 are selected for further evaluation in the second year. These 1,500 lines are grown in short, double-row plots and are selected on the basis of tuber characteristics and cooking tests.

About 200 breeding lines are selected fro Western Australia (WA) each year. Three tubers of each line are brought into the state. Two of these are planted to grow the first WA seed bulking plots of eight plants. The third tuber is sent to WA as a spare.

A tripartite number identifies the breeding lines. For example the advanced breeding line now known as "White Star" was tested as 97-38-2. The "97" indicates the year the first field generation was planted, the middle number "38" indicates the cross (Gladiator x 91-158-6) while the last number "2" indicates that White Star was the second selection from the first field generation of that cross.

Importation

About twenty new varieties are imported into Australia annually. The imported varieties are also screened at the DPIVAF-PBP.

4.2 Quarantine requirements for Western Australia

Potato cyst nematode

WA has quarantine regulations that prohibit the importation of potatoes from Victoria. This is due to the finding of potato cyst nematode (PCN) in Victoria. Although PCN has been recorded in WA it was confined to a discrete area and currently DAFWA and industry is working to gather the evidence that will enable WA Plant Health Officials to claim the pest has been eradicated.

Currently the potato breeding lines are brought into WA under an exemption to the quarantine regulation. Conditions placed on the import of the material are that it is accompanied with a declaration that the paddock in which it was grown was tested for PCN and none was detected. As an additional precaution against PCN the breeding lines must also be dipped in bleach (2% available chlorine for 45 minutes) upon arrival in WA. This treatment can burn sprouts of tubers so it is important the tubers are received soon after harvest before sprouting occurs and that they are thoroughly rinsed after treatment.

Potato virus Y

WA is free from potato virus Y (Holland and Jones, 2005). The breeding lines are tested to ensure only tubers free of the virus are planted. To ensure the seed is suitable for the certified seed scheme in WA the tubers are also tested for PVX, PVS and TSWV

using the ELISA technique. PLRV is tested using the stem-print method. Only those tubers with negative virus results were planted.

The material that is grown under this system will enter the WA Certified Seed Scheme as "G2"due to the intensive virus testing done.

Virus testing of breeding lines and other material introduced from DPIVAF-PBP.

Tubers from DPIVAF-PBP are stored in a cool store at 3°C after treatment with bleach. The tubers are placed in the cool store in June. In early October the tubers are removed from cool store and taken to AGWEST Plant Laboratories. For each breeding line all three tubers were tested. A core is taken from the crown end of each tuber and this is treated with gibberellic acid and planted in individually marked growth cells to allow shoot production. Virus testing is done in groups of three breeding lines: each test comprising three shoots from each tuber of a breeding line with three breeding lines tested together. If a sample tests positive it is possible to re-test tubers from the grouped breeding lines individually to determine if any are free of virus.

4.3 Testing sites and planting times

The first test in WA is a summer grown seed bulking and screening plot which produces seed to plant a winter grown unreplicated screening. This winter screening is the first activity to select breeding lines that will address the industry priority to improve performance of winter grown crops. Seed from the first seed bulking is also used to plant another summer seed bulking plot in year 2 to supply seed for the next testing phase.

The next phase of testing is a replicated district trial. This is planted in the major winter cropping area of Perth. Selections from these trials then proceed to a demonstration phase following a further seed bulking.

A disease screening is grown concurrently with the winter grown district trial. This is used to assess field tolerance to powdery scab and a disorder known as crocodile skin. To ensure disease-screening findings are accurate, the disease screening is repeated in the following year for entries selected for demonstrations.

The demonstrations phase has larger plots but these are unreplicated. Farmers and other industry representatives are invited to participate in the selection of varieties at the harvest of the demonstration.

Type, design & size of experiments

Selection of breeding lines from the Victorian DPI Potato Breeding Program.

Selection of material for testing in WA begins with the second year material grown at the DPIVAF-PBP potato breeding station. A member of the Department of Agriculture and Food, WA (DAFWA) potato evaluation team attends harvest at the DPIVAF-PBP Toolangi to apply a selection bias suitable for the WA industry. This bias includes selection of oblong varieties for the fresh market, varieties that may be susceptible to late blight which show other promising characteristics (this disease is not present in WA), more textured skin than is acceptable in the eastern states fresh market and crisp varieties for the export market.

Three tubers of each of 200-300 selections are supplied by the DPIVAF-PBP. Tubers of standard varieties are also obtained from the DPIVAF-PBP to ensure seed of the standard varieties are of the same generation and physiological age as the breeding lines.

First seed bulking

The first seed bulking is planted in October in the high yielding seed production area of Margaret River. Two of the three tubers are used to plant two-row plots, each with eight plants at 25 cm spacing between setts. The third tuber is a spare for use in case of rots or damage to the other tubers. A buffer area between plots is planted with a contrasting coloured variety to prevent "end-plant" effects.

Unreplicated winter screening

Three tubers from the first seed bulking are set aside the be used as seed for the unreplicated winter screening planted in May in the Perth metropolitan area. This screening allows selection of varieties which perform well in winter. This winter screening is dug in early October to allow selection of material before the next seed bulking is planted at the end of October.

Second seed bulking and replicated screening

Selections from the unreplicated screening are grown in a second seed bulking planted at Margaret River late in the following October. Plots are two rows by 3.6 m having 36 plants on average. The 60 cm of row between plots is planted with a buffer variety having tubers of contrasting skin colour to separate the plots. The use of two row plots is effective and economical as it eliminates "half" the edge effects. Two replicates are planted. The design used is a latinised randomised block design. If the replicates are blocked east-west then the entries are split into two groups which are positioned north-south within the replicate while their positions are reversed in replicate two. A twin row digger is used at harvest. Sufficient seed is produced to plant a district trial and a seed plot for further bulking. For the winter grown district trial the seed is shed-stored. For the October seed bulking at Margaret River seed is cool-stored.

District Trial

The trial is planted in a commercial crop. Two row plots, as described in the replicated screening above, are used with three replicates being planted. About 35 entries are tested each year.

Third seed bulking

Selections from the district trial are grown in a third seed bulking planted at Margaret River late in the following October. Methods used are as described for the second bulking above.

Demonstration

Varieties selected from the district trial are next tested in a demonstration which allows district trial results to be confirmed. It also allows growers and industry representatives to participate in the evaluation of the varieties.

The demonstrations are planted in commercial crops. Unreplicated, double row plots, 15 metres long are planted. Usually six to 12 varieties are tested. We name most of the breeding lines that are tested in demonstrations to allow easy identification. We have found that the breeding line serial numbers were confusing and difficult to memorise.

A field day is held when the demonstrations are harvested. Farmers and industry representatives are asked, at the start of the field day, to inspect the unlabelled, harvested plots which have tubers laid out on the ground. They are asked to vote for their top three varieties using a simple 1, 2, 3 vote. All votes are used to determine the industry's favourites. The votes are weighted as follows; first, or "1" votes are multiplied by 3 then tallied, second, or "2" votes are multiplied by 2 then tallied, third votes are simply added without any weighting. Subsequent discussion at the harvest site can then be directed to the most popular varieties. On-farm testing is the best way to get adoption of new varieties. Varieties selected from the demonstrations will then be tested in a commercial phase.

Commercial tests

The aim of the commercial tests is to confirm the yield and quality results from the district trials and the demonstrations. These tests also allow the new variety to be challenged with the commercial handling practices encountered with mechanical harvesting, bulk transport, washing, packing and retailing.

Two commercial crop locations are chosen to allow the consistency of performance to be assessed. Each farming enterprise is supplied with 500 kg to 3 tonnes of seed, depending on availability. This is enough seed to plant a quarter to one hectare at each site. The planting is done in consultation with the Potato Marketing Corporation of WA and Western Potatoes Ltd who arrange to have the produce from these sites assessed for yield and pack-out.

Consumer tests

Western Potatoes Ltd also conducts consumer reaction to the new varieties undergoing commercial testing. Test potatoes are displayed in a specialty fruit and vegetable store as well as in a major supermarket store.

Customers are told that a new potato variety is being tested. A questionnaire records customer's opinion of the appearance and what they consider is important when judging appearance. Customers are also given cooked samples of the test potato, and a standard for comparison, and asked for comments about the taste of the potatoes.

4.4 Selection criteria

We want to identify varieties that will provide benefits to growers and consumers.

For the fresh market we specifically want to identify higher yielding varieties for winter production that have tolerance to powdery scab and poor weather. Late maturing breeding lines may not be suitable for the short season of winter production. Resistance to PCN is desirable. Culinary quality must be versatile with good boiling quality. Frying quality should also be acceptable.

A future priority for new varieties for the WA industry is likely to be blemish tolerant varieties for summer production to complement Nadine. Here varieties with resistance to blemish diseases (silver scurf and black dot) are required. The varieties must also have low (score of 2 or less) after-cooking-darkening. Versatile cooking quality is also required. At present it is not possible to predict which crosses may have the desired blemish tolerance.

When large scale French fry processing ceased in Manjimup in 1999 we decided to evaluate only those French fry varieties that could also be used for the fresh market. This meant that any new varieties selected required cooking quality and appearance acceptable to both fresh market and French fry processors.

For the crisp market we want improvements in yield and quality over Atlantic. Main quality factors are shape, eye depth, specific gravity, fry colour and internal disorders. Light fry colour and high specific gravity from the cold soils of winter and early spring harvest are also required. Successful crisp production in this period will allow more processing of fresh tubers, rather than stored tubers, plus increased export to processing factories in Asia.

Selection criteria are also discussed with the results of each experiment.

4.5 Measurements

Growth characteristics

Dates when 50% of plants emerged, closed in row, matured and broke dormancy are recorded. Dormancy is assessed by noting when 3 out of 5 tubers, stored under sacks in a shed, have shoots 3 mm long.

Tuber characteristics

At harvest a tick sheet of tuber characters is completed. Skin colour and texture, eye and heel depth, shape and size and uniformity of same, plus faults and disease reaction is recorded. Tuber characteristics are assessed as being suitable, questionable or unsuitable for the market requirements.

Wash pack quality

A sample of 25 tubers is harvested from the demonstration by hand 2 weeks after maturity of each variety. The sample is hand washed and stored in plastic bags for two weeks in the dark at room temperature. The tubers are assessed weekly for; skin bloom, percentage of marketable tubers, amount of rots and amount of shooting. This allows selection of varieties that tolerate washing and storage and maintain their appearance in the market chain.

Disease resistance screening

Powdery scab tolerance is measured in a dedicated powdery scab trial was introduced during the seventh series of fresh market trials using the method of Genet & Braam (1995). This is planted on an infected site in a commercial crop. Five replicates of four plant plots are used. From each plot tubers >30 g are washed and the surface area affected on each tuber is assessed using the following scale:

a) nil,

b) slight (up to 5%),
c) medium (5-25%)
d) severe >25%.

The severity score is calculated from the equation:

$$\text{Severity} = \frac{(b \times 1)+(c \times 2)+(d \times 3)}{a+b+c+d}$$

Entries are tested in two consecutive years in order to confirm the results.

Grading for yield

The grades used vary with market type and are shown in Table 4.5a. Where varieties for several markets are tested in the one trial fresh grading standards are used.

Table 4.5a. Grades yield assessment by market type.

Grade	Market type	
	fresh market	crisp
chats	0- 70 g	0-50 g
small	70-120 g	50-80 g
medium	120-350 g	80-300 g
large	350-450 g	300-430 g
oversize	>450 g	>430 g
marketable*	70-450 g	50-430 g

*Marketable yield was classed as the small to large grade and this was called Grade No. 1 for the fresh market trials.

Internal disorders

For the unreplicated winter screening and the district trial 10 tubers from each plot is assessed for internal disorders. Tubers are cut in half and the number affected by fleck, hollow heart, vascular stain or other disorders are recorded. For demonstrations 50 tubers are assessed.

Specific gravity

A 4 kg sample is used to determine specific gravity using the weight in water weight in air method (Burton 1989).

Cooking

Fry colour

Crisp

This test shows which varieties produce acceptable frying colour for both the crisp, French fry and fresh markets. Five tubers from each plot are tested. Three unpeeled tubers are cut in half longitudinally and two transversely. One half of each tuber is discarded. Slices about 2.2 mm thick are prepared. The first slice from the remaining halves is also discarded, and the next four slices are cooked to give 20 crisps per

sample. The crisps are fried straight away (less than 2 minutes exposure to air) in cottonseed oil at 180°C until bubbling ceases. Crisps are placed in the oil individually to prevent them sticking together. The crisps are then drained and scored for colour using a scale of 1 - 10 shown in Table 4.5b. Oil is changed after 90 frying tests.

Domestic French-fries

Fresh French-fries for domestic use are cooked for assessment by Western Potatoes Ltd at the demonstration stage. French-fries are prepared from three tubers and fried at 170°C for 5 minutes, cooled then re-fried at 190°C for 3 minutes. Overall colour of each French fry is scored on a scale of 1-7 with 1 being white and 7 being dark gold. A score of four or less is acceptable. {This scale equates to the American French fry processors' 000,00,0,1,2,3,4 colour chart, 000 and 00 scores are acceptable in the plant after one minute frying while scores of 0 and 1 are acceptable after full frying in the plant and at home (i.e. about 3'45" frying time in all)}.

Boiling tests

3 tubers from each plot are boiled until soft when tested with a skewer. The tubers are scored for colour, after-cooking-darkening (ACD), sloughing and mash quality. Mash quality is assessed for one of the boiled tubers. This tuber is mashed to a creamy texture and the riciness, or lumpiness, of this mash is assessed by rubbing mash between thumb and forefinger. These tests are done immediately after cooking except for ACD which is assessed after tubers are cold. Details of scoring scales are shown in Table 4.5c.

Demonstration tests

For the fresh market, Western Potatoes assess samples which are cooked at the Department of Agriculture and Food, WA potato laboratory at Bunbury. Tests are as above but a microwave and taste test is added.

Microwave and taste test

Two tubers of about 200g are tested individually. The tubers are washed, dried and there skins pricked. One tuber is placed in a Western Potatoes microwave capsule (*Potato Microwaver*). This is placed in a 750-Watt microwave oven set on high for 2 minutes. The capsule is then turned upside down and microwaved for another 2 minutes to give a total cooking time of 4 minutes. The second tuber is then cooked. After cooking the tuber is removed from the oven and left to stand for 1 minute. The tubers are assessed by cutting in half longitudinally. A knife is used to check for evenness of cooking and evenness of texture. One half of the tuber has its flesh roughed up with a knife to see how it flakes up. The evenness of texture and flakiness are used to give a score of 1 to 4. 1 is "not recommended", 2 is fair, 3 is good and 4 is excellent. The flaking of the flesh also releases aroma which can be assessed.

The tuber is also assessed for taste (Slater *et al.* 2005).

Table 4.5b. Fry colour score sheet used in cooking tests.

Crisp fry colour test			French fry colour test		
Range	Score	Description	Range	Score *	Description
Too light	1	White	↑ Acceptable after 1 minute (') frying for frozen product	1 (000)	White
↑	2	Very light yellow		2 (00)	Very light yellow
	3	Light yellow	↑ Acceptable after 3'45" frying for frozen product	3 (0)	Light yellow
Desired colour	4	Yellow		4 (1)	Yellow
↓	5	Light gold	↓ Acceptable after 5' + 3' frying for fresh product	5 (2)	Light gold
Borderline for crisps	6	Gold	↑ too dark	6 (3)	Gold
Borderline for French fries	7	Dark gold	↓	7 (4)	Dark gold
↑	8	Brown			
Too dark	9	Dark brown			
↓	10	Black			

* American French fry colour chart score shown in brackets

Table 4.5c. Boiling tests, scores and descriptions.

Test	Score	Description
Flesh colour	1	White
	2	Creamy white
	3	Cream
	4	Deep cream
	5	Yellow
Greying and after cooking darkening	1	Nil
	2	Slightly grey
	3	Moderate, greyish black
	4	Marked blackening around eyes and/or stem end
	5	General blackening
Disintegration and sloughing	1	Nil, surface smooth and translucent
	2	Slight, surface dull but mainly intact
	3	Moderate, major part of surface sloughed off but mainly intact
	4	Severe, floury mass
	5	Severe, soupy
Riciness after mashing	1	Nil
	2	Slight
	3	Moderate
	4	Marked

4.6 Statistical analysis

Data from replicated experiments is analysed using analysis of variance. Genstat® statistical software is used and residuals are graphed to determine the validity of the analysis. Where significant effects occur, means are separated from those of the standard variety using the least significant difference method.

An "arcsin" transformation of disease data is used when distribution of raw disease-index is skew. Transformation formula = (asin (sqrt(disease index/100)))*180/pi.

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4.7 Specialised equipment used in project

All trials and seed multiplications are carried out on commercial farms. The variety evaluation team needs to be able to independently plant and harvest trials

Field equipment

Machinery
- truck
- tractor, 2 wheel assist, narrow tyres,
- fork lift for front of tractor
- two row digger
- single row digger
- tool box
- tandem trailer, 1400 kg, 3 m x 1.8 m
- truck tie downs & chains
- tarpaulins

Other heavy equipment
- 500 kg potato bins
- pallettes for fork lift
- portaloo

Grading table
- Scales, battery, 60 kg +/- 10 g
- stackable produce tubs
- 60 L rubbish bins for grading potatoes
- table for data recording
- hand lens
- knife
- portable file
- tally sheets
- camera

Consumables
- net bags
- jute bags
- waterproof labels
- bag wire tie tool
- wire bag ties
- permanent marker pens
- baling twine
- paint
- pegs
- chemicals, various; insecticides, sterilants, herbicides, fungicides

Hand tools
- rakes
- hoes
- forks
- shovel for levelling sites for tables
- rubbish bin and liner bags
- knapsack for herbicide application to (unplanted buffers)
- measuring tapes 100m & 50 m
- trowels for hand planting
- wobblers, (PVC pipes the length of plots with planting distances marked)
- rubbish bins for hand picking potatoes
- 10 L buckets for seed planting
- 20 L buckets for picking up potatoes
- scourers for washing potatoes
- potato forks
- ropes
- ice chest for plant nutrient samples
- bag needle
- soil thermometer
- umbrellas

Safety gear
- first aid kit
- gloves
- hats
- water, soap, towels
- chairs
- mobile phone
- sunscreen
- protective clothing for chemical application
- shade houses, portable

Base

Cooking Laboratory
Commercial fryer with improved temperature control
2 stoves
Microwave oven
electronic balance for specific gravity
tubs for SG measurements
water bath for blanching French fries
timers
cooking oil, “Peerless Cottonseed”
SAPP (sodium acid pyrophosphate) for blanching solution for French fries
paper plates
bench tops for assessing samples
saucepans
slicing mandolin
camera for recording cooking tests

Storage and grading shed
fork lift
cool store, 16 tonnes capacity with low temperature alarm
bin tipper
grader
vacuum cleaner
cleaning equipment
tubs for dipping and rinsing potatoes

5. Results

5.1 Background

Breeding lines from several series were tested.

"98" and earlier series were tested in commercial plantings. These breeding lines included White Star (97-38-2), Auski (95-11-20), Billabong (95-37-12) and Flame (98-34-11).

"00" series breeding lines were tested in demonstrations. These demonstration tests also included some earlier lines, e.g. Michaela (98-4-5), Forester (99-23-11), 97-28-3 and the imported variety Cherry Red.

"01" and "02" series of breeding lines were tested in a replicated summer screening.

"03" series of breeding lines were tested in an unreplicated, summer screening.

"04" series of breeding lines were selected at DPIVAF-PBP Toolangi and brought to WA and tested for virus.

Results of tests are discussed in the order described above.

5.2 "98" & earlier series of breeding lines

5.2.1 Background

The "98" series of breeding lines was first tested in WA in 2000 (Dawson & Mortimore 2004a). Flame (98-34-11) is a selection from this series that is now in early commercial scale tests. Three breeding lines from earlier series are also undergoing commercial evaluation. .These include Auski (95-11-20), Billabong (95-37-12) and White Star (97-38-2). These will be discussed below in reverse order.

5.2.2 Commercial tests White Star

White Star (97-38-2) was first tested in WA in 1999 with the "97" series of breeding lines. It was selected in winter grown experiments (May and July plantings). Its performance was so good in the May 2001 planted district trial (Dawson & Mortimore 2004a) that seed multiplication was accelerated in anticipation of the requirement for early commercial testing. White Star was selected in the May 2002 planted demonstration whilst it was in concurrent small scale commercial tests. Commercial testing progressed through 2003, (Dawson & Mortimore 2004b), 2004 (Dawson & Mortimore 2005) and 2005.

5.2.2.1. White Star Commercial Production Results 2005

The fourth year of commercial scale testing of White Star (97-38-2) was completed in 2005. Complete production and pack-out data for 2004/05 and 2005/06 are given in Table 5.2.2.1 (Larry Hegarty, Potato Marketing Corporation, WA, personal communication). Also shown are sample data from seasons 2002/03 and 2003/04 previously reported by Dawson & Mortimore (2004b).

The data for 2005/06 shows that the 295 tonnes production of White Star received a Class 1 pack-out of 72% compared with Nadine's 59% from 3,500 tonnes. Yield for White Star was 56 t/ha while Nadine averaged 28 t/ha. While the yields reported for the two varieties cannot be strictly compared because they were from different samples, the data convinced industry representatives that White Star should be added to the Potato Marketing Corporation of Western Australia's preferred variety list (Potato Marketing Corporation of WA 2005).

The addition of White Star to the preferred variety list means that growers who deliver this variety to wash-packers are covered under the Pool payment system. It means that the variety has had a *de facto* release in Western Australia.

Table 5.2.2.1. White Star production and pack-out for Pools 2 & 3 for seasons 2002/03 to 2005-06 compared with Nadine. Season 2002/03 gives information for the winter crop grown in 2002.

Measurement	02/03*			03/04*			04/05†			05/06†		
	White Star	Nadine	All	White Star	Nadine	All	White Star	Nadine	All	White Star	Nadine	All
Production & yield												
Area (ha)							2.4	143.7	375.8	5.2	124.5	304.5
Production (t)							117	4,927	13,372	295	3,540	9,363
Yield (t/ha)							49.1	34.3	35.6	56.4	28.4	30.7
Pack out												
Class 1	82	52		76	60		48.3%	48.7%	47.6%	71.7%	59.3%	59.5%
Class 2	9	21		8	17		24.4%	19.0%	20.4%	13.3%	16.1%	15.0%
Small	3	16		10	14		7.6%	20.3%	17.2%	8.6%	15.3%	14.3%
Dry brush							0.0%	0.1%	0.9%	0.0%	0.0%	2.1%
Waste	3	8		4	6		17.6%	10.0%	12.1%	4.3%	7.6%	7.2%
Soil							2.1%	1.9%	1.8%	2.1%	1.8%	1.9%
Total							100.0%	100.0%	100.0%	100.0%	100.0%	100.0%

* from Dawson & Mortimore (2004b)

† PMCWA data.

5.2.3. Benefit Cost Analysis: WA Variety Evaluation Project 2003-2006

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Background

The release of White Star provided a good opportunity to assess the impact of the recent WA variety evaluation work. Mattingley (2006) did this through a benefit cost analysis of three consecutive WA potato variety valuation projects; PT03070, PT04023 and PT05017 which covered a four year period. Mattingley (2006) assessed the projects using an incremental profit method under the two objectives which were to:

- improve variety performance in winter-grown fresh market crops, and to
- develop an improved export crisp variety.

A summary of this benefit cost analysis follows.

Derivation of costs

Project costs were obtained from the project proposal and final report documents submitted to Horticulture Australia Ltd. This information was used in calculating costs and benefits by funding organization, in this analysis benefits accruing to each funding partner have been calculated on a *pro rata* basis. Whilst DAFWA was the major funding provider HAL and the WA potato industry provide significant funding to what is a relatively small, focused project with little in the way of spare resources.

Derivation of benefits

Without the Department's involvement in the introduction and evaluation of new varieties, the process would be considerably slower. The evaluation program has lead to the introduction of a number of varieties including Nadine, Dawmor, Ruby Lou, Eureka and Mondial which are widely grown in Western Australia.

Fresh market analysis

This analysis looked at the development of White Star for the Pool 2 winter market in WA. Typical of many developed countries the fresh market for potatoes in WA is not experiencing significant growth in demand and has a projected increase of just 2 per cent per annum. However winter production in WA has capacity for growth due to limited domestic supplies which are constrained by poor growing conditions. As a result WA imports potatoes from other States during this part of the year. The introduction of the White Star variety will provide a number of benefits for the State:

- Reduced imports of potatoes from interstate
- Increased area planted to potatoes in winter to increase production from 6,500 tonnes to over 8,600 tonnes over a seven year period.
- Increased profitability due to higher packouts and prices compared to the Nadine standard variety and comparable costs of production (see Table 5.2.3.1).

The price used in the analysis is based on data provided by the Potato Marketing Corporation of WA for likely pricing of Nadine and White Star.

Table 5.2.3.1. Gross Margins for Nadine and White Star in Pool 2. Data from Mattingley (2006).

Expenditure and income	White Star	Nadine
Expenditure - ha		
Preparation & establishment ($/ha)	$3,741	$4,408
Crop Management ($/ha)	$2,345	$1,978
Harvesting ($/ha)	$1,916	$1,616
Post Harvest ($/ha)	$1,185	$1,185
Direct costs ($/ha)	$9,187	$9,187
Income – ha		
Yield (saleable) t/ha	38.7	32.63
Price ($/tonne)	493.26	488.08
Gross return $/ha	19,089	15,926
Gross Margin ($/ha)	$10,569	$6,739

The market-share assumptions used for White Star are shown in Table 5.2.3.2. It was assumed that market share would remain constant until year 15 from first year of adoption.

Table 5.2.3.2. Market share assumptions for White Star in Pool 2 (Perth area). Standard and worse case scenario market share is shown. From Mattingley (2006).

Percentage market share by year						
Year	**2003**	**2004**	**2005**	**2006**	**2007**	**> 2008**
Standard assumptions						
White Star %	0.04	0.2	1.7	3.5	40	65
Worst case scenario						
White Star %	0.04	0.2	1.7	3.5	20	30

Export crisp analysis

The main export crisping variety is Atlantic which is preferred by processing factories in SE Asia. The main criteria for a processing company selecting a variety are cost of potatoes, starch content and cooking quality. Any new variety needs to have benefits over Atlantic with higher yield foremost in suppliers minds while quality factors of reduced internal disorders, high specific gravity and light fry colour are paramount to the processor.

Without the introduction of a new variety the market would grow in the medium term at 8 per cent *per annum*, with the introduction of the new variety it will increase at a top rate of 10 per cent. The market penetration of the new variety is shown in Table 5.2.3.3. It is anticipated that market share will remain constant up until year 15 from first year of adoption.

Table 5.2.3.3. Market share of new export crisp potato varieties for standard and worse case scenario. From Mattingley (2006).

Percentage market share by year							
Year	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**	**> 2016**
Standard assumptions							
New crisp variety %	0.04	0.04	0.2	1.7	3.5	15	20
Worse case scenario							
New crisp variety %	0.04	0.04	0.2	1.7	3.5	7.5	10

Average farm gate prices for Atlantic are $270/tonne at 45 tonnes/ha yield, the new variety is expected to command $290/tonne and yield 48 t/ha. Production costs for Atlantic are $5,900/ha, the new variety will have similar costs reflecting marginal increases in management and input costs which will be offset through reduced seed costs. Atlantic sets few tubers, about 6 per plant, and has to be planted at high density to produce the small tubers required for the crisp processing. New varieties will only require ¾ of the quantity of seed compared to Atlantic. It is assumed that prices and production costs will remain static for the purpose of this analysis.

Key Assumptions

Investment appraisal parameters

- Period of evaluation: 15 years
- Discount rate: 7 per cent
- Attribution of benefits to the project: 70 per cent

The project is not 100 per cent responsible for project benefits as marketing companies and grower groups have significant involvement in promoting varieties.

The project was given a high probability of success of 85% as the Potato Project has a very good track record of introducing new varieties such as Nadine, Ruby Lou, Mondial and Dawmor to the benefit of the WA industry. Farmers have confidence in the trial results as they are demonstrated through on-farm trials. In addition Western Potatoes Ltd and the Potato Marketing Corporation of WA, who co-ordinate the marketing of domestic fresh potatoes for the WA market, are closely involved in the variety development process.

Results of benefit cost analysis

Standard assumptions

Table 5.2.3.4 shows the returns on investment to the funding partners. A benefit/cost ratio (BCR) of > 1 indicates that the project generates greater net benefits than costs. The 12.6 BCR from this analysis shows that this project provides a significant return on investment for the WA potato industry.

The net present value figure of $3.4 M (Table 5.2.3.4) shows the discounted incremental benefit of this project (discounted benefits less discounted costs) over a 15 year period. The NPV can be thought of as the additional discounted profits made by WA growers as a result of the investment in the variety development work less the

discounted cost of the project. Discounting is an economic adjustment based on the assumption that people place greater value on something they have today than something they will have in the future. A strongly positive NPV indicates that there are net returns to the State from investing in this series of projects.

Table 5.2.3.4. Returns on funds invested by funding partners. From Mattingley (2006).

Net Present Value ($m)	Benefit Cost Ratio	Project costs over 4 years	Probability of success
Returns on total funds			
$3.44M	12.6	$297,502	85%
Returns on DAFWA funds			
$1.9M	12.6	$164,218	85%
Returns on Horticulture Australia Ltd (HAL) funds			
$1.1M	12.6	$93,744	85%
Returns on Industry funds			
$0.44M	12.6	$39,540	85%

Export only analysis

The domestic supply of the WA potato market is regulated by statute. Some may question the benefits of developing new varieties for a regulated market with arguably distorted returns to industry. Therefore a separate analysis of the benefits of the evaluation work based solely on the benefits of the export focused processing varieties was undertaken and results are shown in Table 5.2.3.5. The analysis has the same costs as the original analysis, no benefits for fresh market varieties and the same benefits as the original analysis for export processing varieties. The findings indicate that if the project were solely focused on export processing varieties it would still provide significant return on investment dollars for the WA potato industry.

Table 5.2.3.5. Returns on funds for export crisp variety evaluation. From Mattingley (2006).

Net Present Value ($m)	Benefit Cost Ratio	Project costs over 4 years	Probability of success
Returns on total funds			
$1.3M	5.3	$297,502	85%

Worse case scenario

It was also decided to investigate the benefit cost ratio with more pessimistic assumptions. These worse case assumptions were that:

- there was no incremental growth in domestic winter fresh or export processing markets, and that
- market share of new varieties was reduced to the 'worse case' assumptions shown in Table 5.2.3.2 and 5.2.3.3.

The results of this worse case analysis are given in Table 5.2.3.6**.** Even with these low adoption rates and no incremental growth in the domestic and export markets the project still provided a return on investment with a BCR of 2.3. This reflects the relatively low cost of the project and its impact across a major industry.

Table 5.2.3.6. Returns on total funds for potato variety evaluation under a worse case scenario of no increase in market sales and low adoption rates of new varieties. From Mattingley (2006).

Net Present Value ($m)	Benefit Cost Ratio	Project costs over 4 years	Probability of success
$0.38M	2.3	$297,502	85%

5.2.4. Commercial tests of Auski and Billabong

5.2.4.1 Background

Two breeding lines identified as potential candidates for summer production that have reached the commercial testing are Auski (95-11-20) and Billabong (95-37-12).

Auski was first tested in WA in 1997 and selected for commercial testing following its selection in an October 2000 planted demonstration at Manjimup. It was tested in two other summer grown demonstrations but its appearance was not ideal in these tests (Dawson & Mortimore 2004a). Auski had its first commercial test in 2004-05 (Dawson & Mortimore 2005).

Billabong, from the "95" series of breeding lines was first tested in WA in 1999 with the "97" series of breeding lines. It was selected in a November 2002 planted demonstration at Pemberton. The disruption to the variety evaluation program caused by the finding of latent PVY is some breeding material meant that Billabong seed was not available for commercial testing until 2004-05 (Dawson & Mortimore 2005).

In 2004/05 both Auski and Billabong were tested in small commercial plots on two farms near Pemberton (Dawson & Mortimore 2005). These breeding lines were selected because they had; better appearance than Delaware, better taste than Nadine, better fry quality than Delaware and Nadine and better skin bloom than Delaware although they showed darker ACD than Delaware (Dawson & Mortimore 2005).

At the first site both Auski and Billabong had at least 10% more Grade 1 than Delaware (Dawson & Mortimore 2005). However there was a greater proportion of Small Grade in these two new varieties compared with Delaware. Delaware produced 30% waste at this site compared with 8 and 10% from Auski and Billabong respectively. At the second site Auski and Billabong were compared with Nadine. Here both Auski and Billabong had similar Grade 1 to Nadine (Dawson & Mortimore 2005). Grade 2 was greater in Auski and Billabong than Nadine but the difference was probably due to the high waste level of 13% in Nadine.

Potatoes from both sites were sent to wash-packers and then to retailers (Dawson & Mortimore 2005). There was concern about the shelf life of Billabong and it was thought that skin set may be a problem. Auski appeared to have superior shelf life.

Overall it was thought that both varieties should progress to another year of commercial testing.

5.2.4.2 2005/06 results

The second commercial test was done during the 2005/06 season. 500kg of seed of each variety was supplied to two growers, Brian & Brett De Campo and RM & AM (Maurice) Humphrey & Son. This was enough seed to plant about 1,000 m^2.

Cooking quality was assessed from samples collected at harvest from both sites (Table 5.2.4.2a). The results were variable with Billabong's ACD varying from a score of 1.5 at Humphrey's to 3.5 at De Campos'. Variation in ACD scores for Auski was less with a range of 2.5 to 3.0. The ACD scores above 2 are a concern: in future cooking samples of standard varieties from the same site should also be assessed. Previous ACD tests from October/November plantings of Billabong averaged score 3.0 while Auski's average score was 2.0 (Dawson & Mortimore 2004a). For both varieties all slough, mash and fry scores were acceptable.

Table 5.2.4.2a. Cooking quality of Auski and Billabong in two November 2005 planted strips at Pemberton. Planted: 18 November 2005 Harvested: 29-30 March 2006 Spacing: 25 cm x 75 cm Soil temp. at harvest: 24°C.

Site & variety	Quality				
	SG	ACD @	Slough ~	Mash ‡	Fry# colour
Humphrey					
Auski	1.066	2.5	2.0	1	6
Billabong	1.071	1.5	1.5	1	4
Decampo					
Auski	1.071	3.0	1	1	3
Billabong	1.077	3.5	1.5	1	4

@ ACD (after cooking darkening): 1 = nil, 2 = slight, 3=moderate, 4 = severe, 5 = general blackening.
~ Sloughing: 1=nil, 2 = slight, 3=moderate, 4 = severe, 5 = soupy.
‡ Mashing/riciness: 1=nil, 2=slight, 3=moderate, 4 = very ricey.
# Samples assessed visually after crisping: 1 - 10, 7 = borderline, >7 = too dark for French fries.

A "field walk" was held at Pemberton Packers to inspect the harvested material from De Campos' site. There was a great difference in the reaction to blemish diseases between the varieties. Auski which matured 4 weeks later than Billabong was very badly affected by skin blemishes which spoiled its appearance. Billabong, which matured 4 weeks prior to Auski, was relatively free from blemish. The blemishes are caused by the fungus pathogens silver scurf (*Helminthosporium solani*) and black dot (*Colletotrichum coccodes*). This resulted in Billabong having a greater "Class 1" pack-

out than Auski (Table 5.2.4.2b). Figure 5.2.4 shows the skin quality of the two varieties from the first year of commercial testing.

Table 5.2.4.2b. Pack-out of a sample of Auski and Billabong from a commercial test at Pemberton in 2005/06. Data from PMCWA.

Variety	Amount (tonnes)	Pack-out (% by grade)				
		Class 1	Class 2	Small	Waste	Soil
Auski	5.2	48%	33%	8%	9%	2%
Billabong	3.5	60%	14%	17%	7%	2%

Figure 5.2.4. Skin quality of Billabong and Auski from a commercial planting at Pemberton in 2004/05. Note that Auski is more affected by blemishes of the skin caused by silver scurf (*Helminthosporium solani*) and black dot (*Colletotrichum coccodes*). The difference in reaction to these blemish diseases was even greater in the 2005/06 commercial test where Auski's appearance even worse.

5.2.5. Commercial testing of Flame (98-34-11)

5.2.5.1 Background

The red skinned Flame (98-34-11) was first selected in WA in a May 2001 planted unreplicated screening (Dawson & Mortimore 2004a). It was then tested in a May 2002 planted district trial where it would have been selected for further testing were it not for 27% of tubers having hollow heart. It was, however, selected from a July 2002 planted district trial and was shown to have good tolerance to powdery scab (Dawson & Mortimore 2005). It was tested in a winter demonstration in 2005 (See Section 5.3.2).

5.2.5.2 2005/06 results

300 kg of Flame (98-34-11) seed was supplied to JC Anderson & Co of Baldivis near Perth. Flame was planted in a commercial strip which will be harvested November 2006. At time of writing the crop had grown well but was still in full leaf.

5.2.6. Seed bulking

Advanced breeding lines selected in earlier variety evaluation projects and which were still undergoing testing in demonstrations or commercial strips were bulked over summer 2005/06 in WA to maintain seed lines. This seed was bulked under the WA Certified seed scheme. Standard varieties were Atlantic, Coliban, Delaware, Desiree, Kennebec, Mondial, Nadine and Ruby Lou. A list of material is given in Table 5.2.6. This list does not include the breeding lines that were tested in the unreplicated and

replicated screenings (Sections 5.5.3 & 5.4.2) as these screening plots supplied sufficient seed to maintain these breeding lines.

Table 5.2.6. Breeding lines in DAFWA seed bulking plots 2005/06.

Plot #	Variety by number	Plot #	Variety by name
1	Cherry Red	15	Auski (95-11-20)
2	Eben	16	Billabong (95-37-12)
3	Maris Piper	1	Cherry Red
4	P03	2	Eben
6	89-27-6 (My Fry)	13	Flame (98-34-11)
7	94-28-1	14	Forester (99-23-11)
15	95-11-20 (Auski)	3	Maris Piper
16	95-37-12 (Billabong)	9	Monaro (97-102-1)
8	96-141-12 (Windsor)	6	My Fry (89-27-6)
5	97-38-2 (White Star)	5	White Star (97-38-2)
9	97-102-1 (Monaro)	8	Windsor (96-141-12)
10	98-4-5		
11	98-27-3		
13	98-34-11 (Flame)		
12	98-107-13		
14	99-23-11 (Forester)		

5.3 "99"& "00" series of breeding lines

5.3.1 Background

The "99" series of breeding lines was first tested in WA in 2001. In 2003, when a symptomless PVY strain was found in some breeding lines, testing was delayed while the breeding lines were tested for the virus (Dawson & Mortimore (2004b). The "00" series of breeding lines were similarly affected. Testing continued with the May 2004 planted district trial at Mandogalup (Perth) with mostly "00" series breeding but there were also entries from the "97", "98" and "99" series of breeding lines.

5.3.2 Demonstration of fresh varieties 2005-06

5.3.2.1. Winter Demonstration of fresh varieties

Aim and background

To select entries that merit commercial testing for winter production on the Swan coastal plain. Entries were selected from a May 2004 planted district trial at Mandogalup (Dawson & Mortimore 2005). Mainly breeding lines from the "00" series were tested but "99" to "97" series breeding lines were also represented. Two breeding lines not selected in the previous season's district trial were 98-34-11 (Flame) and 96-141-12 (Windsor). Flame (98-34-11) was added for its performance in a July 2002 planted trial at Jindong (Busselton)(Dawson & Mortimore 2004a) and because it was shown to have good tolerance to powdery scab (Dawson & Mortimore 2005). Windsor (96-141-12) was also included because (Dawson & Mortimore 2004a) recommended it should be tested against White Star to see which had superior winter cooking quality. Entries are shown in Table 5.3.2.1.

Results

The demonstration was planted in mid May and grew well with the standard variety Mondial producing 79 t/ha of Grade No 1 tubers with nine of the 12 varieties producing over 50 t/ha (Table 5.3.2.1). Selection criteria were suitable tuber characteristics, yield greater than 50 t/ha, specific gravity greater than Nadine, three of the culinary tests to be good or higher with two fair or higher, skin bloom on at least 10% of tubers and tolerance to powdery scab. Selections were White Star and Flame.

Growers and other industry representatives selected varieties based on appearance of the harvested tubers plus cooking test data. The plots were not labelled while industry representatives voted. Their selections were decided by vote. Results were; White Star 25 votes (8 first votes and 1 third vote), Flame 12 votes (1 first vote, 3 second votes and 3 third votes) and Maris Piper 9 votes (2 first votes, 2 second votes and 1 third vote)(Table 5.3.2.1).

Both White Star and Maris Piper have previously been tested in demonstrations previously (Dawson & Mortimore 2004a) and are already undergoing commercial tests. This was however the first demonstration test of Flame and its selection means it should progress to commercial tests next season (see Section 5.2.4).

Table 5.3.2.1. Yield and quality of fresh market entries in a May 2005 planted demonstration at Baldivis.

Planted: 18 May 2005 | Harvested: 19 October 2005 | Soil temperature at harvest: 20°C
Row spacing: 75 cm | Soil type: alkaline sand | Elevation: 20 m

Entry, tuber characteristics* & spacing in row	(cm)	Yield (t/ha) Chats 0-70g	Small 70-120g	Med-ium 120-350g	Large 350-450g	Grade No 1 70-450g	Over size >450g	Rank by Grade No 1	Tuber no per plant	Quality SG	Culinary tests# taste	salad	mash	micro	fry	Flesh† faults (%)	% skin bloom (14 days)	Pwd@ scab	Field day votes
Selection criteria																			
Suitable						>50				>1.053	3 tests > 1 star, no test < 1 star						>10	tol	
White skin																			
Delaware	25	5.4	16.1	53.7	0.0	69.8	0.0	4	13.8	1.064	**	**	**	**	*	0	0	tol[3]	
Forester (99-23-11)	25	2.1	7.7	38.5	0.0	46.2	0.0	10	7.4	1.083	*	*	**	**	***	0	0	tol§[5]	
Liberty (00-58-1)	30	4.4	12.9	31.4	0.0	44.3	0.0	11	11.6	1.080	**	**	**	**	***	0	56	tol§[5]	
Maris Piper	30	2.8	9.8	58.2	0.2	68.2	0.0	5	11.3	1.069	***	**	**	**	*	0	40	tol[3]	9
Mondial	15	2.0	3.9	63.2	11.9	79.0	8.1	2	6.2	1.058	*	***	*	**	nr	0	16	tol[1]	
Nadine	25	3.2	12.0	47.3	1.7	61.0	0.0	6	10.4	1.053	nr	***	*	***	nr	0	76	sus[1]	
Outback (98-109-1)	30	2.1	4.2	50.5	0.7	55.3	0.2	8	9.2	1.074	***	**	**	**	***	0	4	tol[4]	
Victoria	30	2.8	4.5	37.8	0.5	42.8	0.2	12	8.8	1.070	**	***	*	*	**	2	28	tol§[5]	
White Star	30	1.2	2.8	56.0	2.0	60.8	0.0	7	8.1	1.065	**	**	***	**	***	0	32	tol[3]	25
Windsor (96-141-12)	25	1.8	3.7	42.5	6.1	52.2	0.9	9	7.2	1.075	**	*	**	**	***	0	0	sus?[3]	
Red skin																			
Ruby Lou	20	2.4	8.4	63.5	3.3	75.1	0.0	3	8.0	1.070	***	***	***	**	***	0	60	h sus[1]	
Flame (98-34-11)	25	3.6	14.5	64.5	5.6	84.6	0.0	1	12.0	1.065	*	*	**	**	**	2	32	tol[4]	12
Significance																ns			

* Tuber characteristics: **bold** face = suitable, plain = questionable, *italic* = unsuitable.
# Potato Marketing Corporation assessment: *** = excellent, ** = good, * = fair, nr = not recommended.
† Flesh faults; † indicates significantly different internal disorders from Delaware.
@ Tested in disease screening trials, 2 consistent results over 2 seasons required: tol = tolerant, h = highly, sus =susceptible, ? = inconsistent results, § = 1 test only.

1. Dawson & Mortimore (2000)
2. Dawson & Mortimore (2000, 2004a)
3. Dawson & Mortimore (2004a)
4. Dawson & Mortimore (2004a, 2005)
5. Dawson & Mortimore (2005)

5.3.2.2. Summer demonstration of fresh varieties

Aims and Background

1. To test the suitability of the red skinned variety Cherry Red for summer cropping at Pemberton.
2. To test the suitability of 98-4-5 for summer cropping at Pemberton. It was selected for demonstrations following district trials in 2002 (Dawson & Mortimore 2004a). In the replicated screening at Margaret River 98-4-5 had relatively low ACD.
3. To demonstrate that White Star is unsuitable for summer production at Pemberton. This will ensure that valuable seed which is in short supply is not diverted to inappropriate growing areas.

Results

The first demonstration site tested all three aims. The demonstration grew well with Ruby Lou, the standard WA red skinned variety producing 59 t/ha of Grade No. 1 yield (Table 5.3.2.2a). Cherry Red produced a similar yield of 60 t/ha but had a deeper red colour than Ruby Lou. Other advantages of Cherry Red were:

- lack of internal disorders compared with Ruby Lou which had 22% of tubers affected by fleck, and
- lower ACD compared with Ruby Lou.

A disadvantage of Cherry Red was its greater sloughing score compared with Ruby Lou.

White Star produced misshapen tubers with deep eyes which were considered unsuitable for the fresh market. This confirms the assessment from the previous summer grown demonstration which was planted in November 2002 (Dawson & Mortimore 2004a). Note that White produces suitable tuber characteristics for the fresh market when in is planted from April to July. For more details see Section 5.2.2.1.

98-4-5 (Michaela) had questionable tuber characteristics with long-oblong tubers with slightly deep eyes. Yield was high at 72 t/ha and skin bloom was excellent after two weeks storage in a plastic bag.

Table 5.3.2.2a. Yield and quality of fresh entries in a November 2005 planted demonstration at Pemberton.

Planted: 18 November 2005	Harvested: 29 March 2006	Soil type: grey sand
Row spacing: 75 cm	Soil temp. at harvest: 24°C	Elevation: 120 m

Entry, tuber* characteristics & spacing in rows (cm)	Yield (t/ha)						Tuber no. per plant	Quality					
	Chats 0-70g	Small 70-120g	Medium 120-350g	Large 350-450g	Grade No. 1 70-450g	Oversize >450g		SG	ACD @	Slough ~	Fry# color	Flesh† faults (%)	Skin bloom (% 14 days)
Selection criteria													
Suitable													
Cherry Red 25	2.5	6.9	50.6	2.0	59.5	0.7	9.5	1.069	2	3	7	0†	24
Ruby Lou 25	2.3	8.7	48.4	1.8	58.9	0.2	-	1.071	3	2	5	22	28
White Star 25	1.6	3.9	54.7	7.1	65.6	5.5	8.0	1.067	2	1	5	14	24
98-4-5 (Michaela) 25	5.1	10.9	59.2	1.8	71.8	0.8	12.8	1.061	2	2	5	0†	96
Significance												*	

* Tuber characteristics: **bold** typeface = suitable, plain type = questionable, *italic* = unsuitable.
@ ACD (after-cooking-darkening): 1 = nil, 2 = slight, 3 = moderate, 4 = severe, 5=general blackening
~ Sloughing: 1 = nil, 2 = slight, 3 = moderate, 4 = severe, 5 = soupy.
# Samples assessed visually after crisping: 1 - 10, 7 = borderline, >7 = too dark for domestic French-fries.
† indicates significantly lower levels of internal flecking than Ruby Lou.

Michaela (98-4-5) was also tested at two other sites and results are shown in Table 5.3.2.2b. ACD ranged from 1.5 to 2.0. This is darker than desired as Nadine usually produces a score of less than 1.5. Tuber characteristics were also questionable at some sites as Michaela tended to grow quite large and long. Michaela should not progress to commercial testing but should be re-tested in the November 2006 planted district trial. In this trial Michaela's response to density should be examined to determine whether this will improve uniformity of size and shape of the tubers while providing an opportunity to confirm whether the variety really does have low ACD.

Table 5.3.2.2b. Yield and quality of Michaela (98-4-5) in three November 2005 planted demonstration strips at Pemberton.

Planted: 18 November 2005	Harvested: 29-30 March 2006	Soil type: various
Density: 25 x 75 cm	Soil temp. at harvest: 24°C	Elevation: 120 - ??? m

Site	Yield (t/ha)						Tuber no. per plant	Quality					
	Chats 0-70g	Small 70-120g	Medium 120-350g	per plant 350-450g	Grade No. 1 70-450g	Oversize >450g		SG	ACD @	Slough ~	Mash ‡	Fry# colour	Flesh† faults (%)
Humphrey	3.2	7.2	56.4	6.1	69.7	1.1	10.0	1.064	1.5	3.5	1	8	0
Decampo	5.8	6.8	38.1	2.7	47.6	1.3	10.5	1.060	2.0	1	1	8	0
Ryan	5.1	10.9	59.2	1.8	71.8	0.8	12.8	1.061	2.0	2	1	5	0

@ ACD (after cooking darkening): 1 = nil, 2 = slight, 3=moderate, 4 = severe, 5 = general blackening.
~ Sloughing: 1=nil, 2 = slight, 3=moderate, 4 = severe, 5 = soupy.
‡ Mashing/riciness: 1=nil, 2=slight, 3=moderate, 4 = very ricey.
# Samples assessed visually after crisping: 1 - 10, 7 = borderline, >7 = too dark for French fries.
† From sample of 50 tubers.

5.3.3 Demonstration of crisp varieties 2005-06

Aim and Background

The aim was to confirm the suitability of Forester (99-23-11) for winter crisp production. Forester was the sole crisp selection from a May 2004 planted district trial at Mandogalup (Perth) where it produced significantly ($P<0.05$) higher yield than Atlantic with specific gravity and fry colour not being significantly different (Dawson & Mortimore 2005). We also wanted to test the suitability of 98-27-3 for summer production as this breeding line had previously been selected at this time of year in a district trial in 2002 (Dawson & Mortimore 2004a) where it had significantly higher specific gravity than Atlantic. The new crisp variety Bliss, which is already being adopted for late summer crops, was added to allow the grower an assessment of its potential for winter and spring production.

5.3.3.1. July planting at Lancelin

Results

Emergence of Atlantic was just 80% with better results from Bliss and Forester with 100% and 95% emergence respectively. The demonstration grew poorly with the canopy nowhere near closing following a severe set-back early in growth. The poor growth may have been due to inadequate fertilizer. At harvest there were many powdery scab (*Spongospora subterranea*) galls on the roots. Atlantic and Bliss both had fairly severe powdery scab lesions on their tubers while Forester tubers were noticeably less affected. Yields were very low with Atlantic producing just 10 t/ha (Table 5.3.3.1). With such low yields selection from this demonstration is not sensible. The following September planted demonstration, described in the next section provided better results.

Table 5.3.3.1. Yield and quality of crisp entries in a July 2005 planted demonstration at Lancelin.

Planted: 7 July 2005 Row spacing: 75 cm		Harvested: 11 November 2005 Soil temp. at harvest: 17°C							Soil type: grey sand Elevation: 100 m			
Entry tuber* characteristics & spacing in rows	(cm)	Yield (t/ha) Chats 0-50g	Small 50-80g	Medium 80-300g	Large 300-430g	Crisp Grade 50-430g	Oversize >430g	Rank by Crisp Grade	Tuber no. per plant	Quality SG	Fry# color	Flesh faults †
Selection criteria												
Suitable										≥1.085	<7	
Atlantic	20	1.9	4.2	5.7	0.0	9.9	0.0	3	3.9	1.094	4	14
Bliss	20	4.8	6.6	8.5	0.0	15.2	0.0	1	7.4	1.104	5	0+
Forester (99-23-11)	25	5.3	6.1	5.9	0.0	12.0	0.0	2	9.1	1.092	5	0+
Significance												*

* Tuber characteristics: **bold** typeface = suitable, plain type = questionable, *italic* = unsuitable.
# Samples assessed visually after crisping: 1 - 10, 6 = borderline, >6 = too dark for crisps.
† indicates significantly different flesh disorders from Atlantic.

5.3.3.2. September planting at Lancelin

Results

Two plots of the standard variety were grown to compare the grower's seed {shown as Atlantic (grower) in Table 5.3.3.2a} with the experimental seed {Atlantic (DAFWA)}. Emergence of Atlantic (grower) was 90% with Atlantic (DAFWA) having 85% emergence. Bliss had 98% emergence and Forester had 97%. The demonstration grew well with Atlantic averaging 61 t/ha (Table 5.3.3.2a). Bliss also produced a high yield of 76 t/ha while Forester produced the lowest yield of 48 t/ha. Forester also had lower specific gravity than Atlantic, 1.080 versus 1.084. Bliss had specific gravity of 1.087, slightly higher than Atlantic's specific gravity.

Table 5.3.3.2a. Yield and quality of crisp entries in a September 2005 planted demonstration at Lancelin.

Planted: 13 September 2005 Row spacing: 75 cm		Harvested: 12 January 2006 Soil temp. at harvest: 20°C								Soil type: grey sand Elevation: 100 m		
Entry		Yield (t/ha)						Rank	Tuber	Quality		
tuber* characteristics & spacing in rows	(cm)	Chats 0-50g	Small 50-80g	Med-ium 80-300g	Large 300-430g	Crisp Grade 50-430g	Over size >430g	by Crisp Grade	no. per plant	SG	Fry# color	Flesh faults †
		Selection criteria										
Suitable										≥1.083		
Atlantic (DAFWA)	20	2.9	3.5	52.4	2.0	57.9	0.0	3	10.0	1.086		12
Atlantic (grower)	20	1.9	5.3	58.0	1.6	64.9	0.0	2	9.7	1.083		6
Bliss	20	3.8	6.7	67.9	1.6	76.3	0.0	1	12.1	1.087		2
Forester (99-23-11)	25	4.6	12.2	36.0	0.0	48.2	0.0	4	15.1	1.080		6
Significance												ns

* Tuber characteristics: **bold** typeface = suitable, plain type = questionable, *italic* = unsuitable.
# Samples assessed visually after crisping: 1 - 10, 6 = borderline, >6 = too dark for crisps.
† indicates significantly different flesh disorders from Atlantic (plot), 50 tuber sample.

The quality of entries was also assessed by a processing company (Table 5.3.3.2b). These samples showed that Forester had similar specific gravity to both Atlantic samples but many less defects. Forester had 2.8% defects while Atlantic averaged 12.5% defects. Bliss was shown to have a specific gravity of 1.090 which was much higher than Atlantic (Table 5.3.3.2b). Bliss also had a much lower percentage of defects compared with Atlantic, 3.2 % versus 12.5%.

Table 5.3.3.2b. Crisp processor quality assessment of entries in a September 2005 planted demonstration at Lancelin.

Entry	Tubers in 10 kg	Specific gravity	Chip defect %	Chip defect Description
Atlantic (DAFWA seed)	67	1.083	13.2	colour/greening/internal & external bruising/external & internal browning of crisp
Atlantic (grower's seed)	66	1.082	11.7	internal & external white bruising/ external & internal browning of crisp
Bliss	63	1.090	2.8	external browning & bruising
			0.6	dark to undesirable colour
Forester (99-23-11)	84	1.082	1.2	external browning
			1.6	undesirable due to excess oil

5.3.3.3 November planting at Lancelin

Results

The two row plots of Bliss and Forester were hand planted next to a crop of FL1867. A patch of Atlantic was then meant to be planted on the other side of the Bliss and Forester by the grower. This Atlantic was not planted and so the experimental plots ended up as outside rows while the closest Atlantic was 50 m away on the other side of the FL1867 patch. Table 5.3.3.3 shows that Bliss and Forester yield was only about half the yield of Atlantic. The low yield was most likely due to the outside row effect. The quality of Bliss and Forester was better than Atlantic with higher specific gravity and lower internal defects.

Table 5.3.3.3. Yield and quality of Bliss and Forester in a November 2005 planted demonstration at Lancelin.

Note: Bliss and Forester ended up as outside rows while the nearest Atlantic which used for comparison was 50 away on the other side of a patch of FL1867.

Planted: 11 November 2005 Row spacing: 75 cm	Harvested: 1 March 2006 Soil temp. at harvest: ?°C								Soil type: grey sand Elevation: 100 m			
Entry	Yield (t/ha)						Rank	Tuber	Quality			
tuber* characteristics & spacing in rows (cm)	Chats 0-50g	Small 50-80g	Med-ium 80-300g	Large 300-430g	Crisp Grade 50-430g	Over size >430g	by Crisp Grade	no. per plant	SG	Fry# color	Flesh faults †	
	Selection criteria											
Suitable									≥1.075			
Atlantic (50 m away)	20	3.1	5.2	35.4	0.0	40.7	0.0	1	9.0	1.063		10
Bliss	20	7.4	7.5	17.1	0.0	24.9	0.0	2	10.7	1.084		0†
Forester (99-23-11)	25	7.6	7.6	11.7	0.0	19.3	0.0	3	12.5	1.070		2
Significance												*

* Tuber characteristics: **bold** typeface = suitable, plain type = questionable, *italic* = unsuitable.
# Samples assessed visually after crisping: 1 - 10, 6 = borderline, >6 = too dark for crisps.
† indicates significantly different flesh disorders from Atlantic, 50 tuber sample.

5.3.3.4. March/April planting at Lancelin

Aim
To commence commercial testing of the new crisp variety Bliss and the advanced breeding lines Forester (99-23-11) at Lancelin.

Results
The farmer planted strips of Bliss (4 rows by 100 m) and Forester (2 rows by 100 m) in a crop of Atlantic. Thirty metres of single row of each variety plus Atlantic was harvested and measured for yield, specific gravity and internal defects (Table 5.3.3.4). This area equals our usual demonstration plot of 2 rows by 15 metres. Crisp grade yield of Atlantic was 34 t/ha while Bliss was similar at 36 t/ha but Forester had lower yield of 25 t/ha. Specific gravity was highest for Bliss at 1.085 while Atlantic reached 1.076 with Forester recording a similar result of 1.075. Atlantic had 20% of tubers with defects while both Bliss and Forester recorded no defects.

Table 5.3.3.4. Yield and quality of crisp entries in March/April 2006 planted strips at Lancelin.

Planted: March/April 2005 Row spacing: 75 cm		Harvested: 4 August 2006 Soil temp. at harvest: not recorded							Soil type: grey sand Elevation: 100 m				
Entry		Yield (t/ha)						Rank	Tuber	Quality		
tuber* characteristics & spacing in rows	(cm)	Chats 0-50g	Small 50-80g	Medium 80-300g	Large 300-430g	Crisp Grade 50-430g	Oversize >430g	by Crisp Grade	no. per plant	SG	Fry# color	Flesh faults †
		Selection criteria										
Suitable										≥1.075		
Atlantic (crop)	20	4.2	10.3	23.8	0.0	34.1	0.0	2	-	1.076	4	20
Bliss	20	3.1	6.8	29.4	0.0	36.2	0.0	1	-	1.085	5	0†
Forester (99-23-11)	25	3.9	6.6	18.4	0.0	25.1	0.0	3	-	1.075	6	0†
Significance												*

* Tuber characteristics: **bold** typeface = suitable, plain type = questionable, *italic* = unsuitable.
# Samples assessed visually after crisping: 1 - 10, 6 = borderline, >6 = too dark for crisps.
† indicates significantly different flesh disorders from Atlantic, 50 tuber sample.

5.3.3.5. November planting at Pemberton

Aim
To determine the suitability of Forester and 98-27-3 for crisp production from a November planting at Pemberton.

Results
Atlantic had poor emergence of 70% while the other entries had better results with 98-27-3 having 93%, Bliss having 95% and Forester with 99%. Tuber characteristics were suitable for crisp processing for all but 98-27-3 which bulged at the heel-end of the tuber. Atlantic yielded 56 t/ha of crisp grade tubers (Table 5.3.3.5) which was lower than 98-27-3's 64 t/ha, Forester's 66 t/ha and Bliss's at 70 t/ha. 98-27-3 and Bliss had specific gravity of 1.092 and 1.093 respectively which was much higher than Atlantic's 1.082 (Table 5.3.3.5). Forester's

1.081 specific gravity was similar to Atlantic's. 98-27-3 had 12% of tubers affected by hollow heart. In the previous test Dawson & Mortimore (2004a) found 20% of tubers affected by the same disorder. This demonstration showed that 98-27-3 is susceptible to hollow heart, has questionable tuber characteristics and so should not be tested further even though its yield and specific gravity were higher than Atlantic.

Table 5.3.3.5. Yield and quality of crisp entries in a November 2005 planted demonstration at Pemberton.

Planted: 15 November 2005 Row spacing: 75 cm		Harvested: 30 March 2006 Soil temp. at harvest: 24°C							Soil type: red sandy loam Elevation: 120 m			
Entry tuber* characteristics & spacing in rows (cm)		Yield (t/ha) Chats 0-50g	Small 50-80g	Med-ium 80-300g	Large 300-430g	Crisp Grade 50-430g	Over size >430g	Rank by Crisp Grade	Tuber no. per plant	Quality SG	Fry# color	Flesh faults †
Selection criteria												
Suitable										≥1.080		
Atlantic	15	1.4	3.6	50.7	1.8	56.1	0.9	4	8.2	1.082		2
Bliss	20	1.5	3.2	65.9	1.0	70.1	0.0	1	10.1	1.092		6
Forester (99-23-11)	25	1.4	2.7	60.1	3.2	66.0	0.2	2	9.7	1.081		0
98-27-3	20	1.1	3.5	49.7	10.6	63.9	2.9	3	7.6	1.093		12†
Significance												*

* Tuber characteristics: **bold** typeface = suitable, plain type = questionable, *italic* = unsuitable.
# Samples assessed visually after crisping: 1 - 10, 6 = borderline, >6 = too dark for crisps.
† indicates significantly different flesh disorders from Atlantic, 50 tuber sample.

5.4. "01" & "02" Series of Breeding Lines

5.4.1 Background

A replicated screening was grown and assessed. Entries were from the "01" and "02" series breeding lines selected from the previous summer planted seed bulking (Dawson & Mortimore 2005). These lines were initially bulked for selection in a winter screening planned for May 2005 planting. However with the addition to White Star to the preferred variety list of the Potato Marketing Corporation of WA (2005), the selection priority changed to blemish free, low ACD varieties for summer production at Manjimup/Pemberton (see Section 5.6.1). Therefore the suitability of the "01" and "02" breeding lines for summer production was evaluated using harvest notes of tuber characteristics from the seed bulking.

5.4.2 Replicated summer screening 2005-06

Aims

To select fresh market and crisp ex port breeding lines from the "01" and "02" series of breeding lines (Dawson & Mortimore 2005) in a replicated screening in a commercial seed crop at Margaret River in 2005/06.

Results

Fresh market

Breeding lines previously selected for both the crisp and fresh market were planted together. Those which were characterised as fresh market types at harvest, according to tuber characteristics, are shown in Table 5.4.2.1.

Selection criteria were as follows: entries had to have suitable tuber characteristics, specific gravity greater than 1.062 (highly significantly greater than Nadine), after cooking darkening and slough both less than 3 with acceptable fry colour (≤ 8). No other major faults were allowed.

The three selections were 00-6-24, 01-34-18, 02-37-1, 02-76-13 and 02-87-11.

Crisps for export

Breeding lines which were characterised as suitable for crisp processing, according to tuber characteristics, are shown in Table 5.4.2.2.

Selection criteria was as follows: entries had to have suitable or questionable tuber characteristics, specific gravity greater than 1.072 (not significantly less than Atlantic) with fry colour less than 6.6 and internal faults not significantly greater than Atlantic. No other major faults were allowed.

The selections were Bliss, Ruby Lou, 00-15-40, 00-58-1, 01-55-10, 01-82-18 and 02-29-5.

Table 5.4.2.1 Yield and quality of fresh market entries in a November 2005 planted replicated screening at Margaret River.

Planted: 3 November 2005 Row spacing: 75 cm				Harvested: 9 March 2006 Soil temp. at harvest: 20°C						Soil type: sandy loam Elevation: 20 m			
Entry, tuber* characteristics & spacing in rows		Yield (t/ha)						Rank by Grade No.1	Tuber no. per plant	Quality			
		Chats	Small	Med-ium	Large	Grade No. 1	Over size			SG	ACD @	Sloug-hing~	Fry# colour
	(cm)	0-70g	70-120g	120-350g	350-450g	70-450g	>450g						
Selection criteria													
Suitable						>45.2				>1.062	<3.0	<3	≤8
Auski	24	8.9	27.1	31.9	0.0	59.0	0.0	10	12.7	1.068	3.5	1.0	4.0
Billabong	30	7.2	18.3	37.7	0.0	56.1	0.0	15	13.8	1.072	3.8	1.3	5.5
Coliban	15	6.0	17.7	46.9	0.7	65.4	0.0	5	7.1	1.067	3.3	1.0	6.0
Delaware	20	7.3	17.6	47.3	1.1	65.9	0.0	4	9.7	1.069	3.8	1.0	7.0
Desiree	20	8.9	22.0	38.2	0.0	60.2	0.0	9	10.6	1.078	2.5	1.5	6.5
Mondial	15	13.4	30.9	36.6	0.0	67.6	0.0	3	9.6	1.063	3.8	1.0	7.5
Nadine	24	13.7	27.4	37.8	0.0	65.2	0.0	6	17.3	1.048	2.3	1.0	10.0
Ruby Lou	20	6.6	27.4	29.7	0.0	57.1	0.0	11	9.8	1.073	2.8	1.3	4.0
00-06-24	24	8.2	23.2	32.7	0.4	56.2	0.0	13	11.9	1.069	1.0	1.3	6.0
00-58-1	30	13.4	25.8	24.0	0.0	49.8	0.0	20	16.1	1.086	4.3	1.8	5.0
01-03-5	24	8.0	21.9	39.8	1.4	63.0	0.0	8	12.1	1.074	4.8	1.5	6.5
01-08-18	30	10.3	20.3	15.7	0.0	36.0	0.0	30	12.8	1.081	1.3	2.5	5.0
01-20-23	24	6.7	14.9	60.2	1.8	76.9	0.5	1	11.6	1.058	2.8	1.0	6.5
01-34-18	24	9.0	25.1	31.6	0.0	56.7	0.0	12	11.7	1.079	2.5	1.0	7.5
01-55-10	30	7.3	17.8	25.1	0.0	42.9	0.0	25	11.9	1.089	3.5	1.3	4.5
01-56-11	30	12.4	25.6	25.0	0.4	51.0	0.0	18	17.0	1.092	4.3	2.8	4.0
01-88-6	24	15.3	29.8	17.8	0.0	47.6	0.0	22	14.3	1.081	4.0	1.0	5.0
02-35-3	24	5.0	16.6	38.6	1.0	56.2	0.0	14	10.4	1.066	4.3	1.0	6.5
02-35-4	24	3.8	9.3	42.6	1.1	53.0	0.0	16	7.9	1.071	4.0	2.5	6.0
02-37-1	24	3.6	14.4	60.7	0.0	75.1	0.0	2	10.5	1.073	2.0	2.8	8.0
02-70-1	24	1.6	7.8	54.7	1.8	64.3	0.0	7	7.4	1.088	3.0	1.8	5.5
02-76-3	24	17.8	31.5	9.9	0.0	41.4	0.0	26	13.6	1.072	1.3	1.8	4.5
02-76-13	24	6.4	25.3	19.2	0.3	44.9	0.0	24	10.5	1.065	2.5	1.8	6.5
02-77-11	36	17.1	25.6	13.9	0.0	39.5	0.0	28	20.3	1.072	3.8	1.5	4.5
02-84-11	24	2.8	5.6	34.3	0.0	39.9	0.0	27	5.9	1.082	2.8	1.5	5.5
02-86-20	24	9.1	24.4	27.2	0.0	51.6	0.0	17	12.2	1.069	3.3	1.0	5.0
02-87-7	24	8.4	30.9	19.4	0.0	50.3	0.0	19	12.1	1.065	2.5	1.5	5.5
02-87-10	24	7.6	16.4	28.6	0.3	45.3	0.4	23	9.8	1.064	3.3	1.3	6.0
02-87-11	24	10.9	16.7	19.8	0.7	37.3	0.0	29	10.8	1.070	2.3	1.3	7.5
02-89-2	30	11.2	24.0	25.3	0.0	49.3	0.0	21	15.4	1.058	2.3	1.5	6.0
Significance+													
LSD P = 0.05						14.7			2.1	0.006	0.9	0.7	1.6
LSD P = 0.01										0.014			

***** Tuber characteristics: **bold** typeface = suitable, plain type = questionable, *italic* = unsuitable.
@ ACD (after-cooking-darkening): 1 = nil, 2 = slight, 3 = moderate, 4 = severe, 5=general blackening
~ Sloughing: 1 = nil, 2 = slight, 3 = moderate, 4 = severe, 5 = soupy.
# Samples assessed visually after crisping: 1 - 10, 7 = borderline, >7 = too dark for domestic French-fries.
+ "skew" indicates data did not fulfil assumptions of analysis of variance.

Table 5.4.2.2 Yield and quality of crisp entries in a November 2005 planted replicated screening at Margaret River.

Planted: 3 November 2005 Row spacing: 75 cm				Harvested: 9 March 2006 Soil temp. at harvest: 20°C						Soil type: sandy loam Elevation: 20 m			
Entry, tuber* characteristics & spacing in rows		Yield (t/ha)						Rank by Grade No.1	Tuber no. per plant	Quality			
		Chats	Small	Med-ium	Large	Grade No. 1	Over size			SG	ACD @	Fry# colour	Flesh faults
	(cm)	0-70g	70-120g	120-350g	350-450g	70-450g	>450g						(%)
Selection criteria													
Questionable						>48.5				>1.072		<6.6	
Atlantic	15	7.0	23.8	44.7	0.0	68.5	0.0	1	7.8	1.078		5.0	0
Bliss	20	9.4	29.0	33.1	0.0	62.1	0.0	2	10.5	1.093		4.5	0
Ruby Lou	20	6.6	27.4	29.7	0.0	57.1	0.0	4	9.8	1.073		4.0	20
00-15-40	30	30.1	24.6	4.2	0.0	28.9	0.0	10	22.5	1.077		4.5	0
00-58-1	30	13.4	25.8	24.0	0.0	49.8	0.0	5	16.1	1.086		5.0	0
01-1-1	40	18.6	17.2	6.6	0.0	23.8	0.0	11	21.3	1.083		5.0	50
01-55-10	30	7.3	17.8	25.1	0.0	42.9	0.0	8	11.9	1.089		4.5	0
01-82-18	36	17.1	23.9	9.6	0.0	33.5	0.0	9	18.8	1.090		4.5	0
01-88-6	24	15.3	29.8	17.8	0.0	47.6	0.0	7	14.3	1.081		5.0	0
02-29-5	24	5.7	12.9	47.1	1.1	61.1	0.0	3	9.8	1.074		4.5	0
02-89-2	30	11.2	24.0	25.3	0.0	49.3	0.0	6	15.4	1.058		6.0	0
Significance+													
LSD P = 0.05						14.7			2.1	0.006	0.9	0.7	1.6
LSD P = 0.01						20.0				0.014			

* Tuber characteristics: **bold** typeface = suitable, plain type = questionable, *italic* = unsuitable.
@ ACD (after-cooking-darkening): 1 = nil, 2 = slight, 3 = moderate, 4 = severe, 5=general blackening
# Samples assessed visually after crisping: 1 - 10, 7 = borderline, >6 = too dark for crisps.
+ "skew" indicates data did not fulfil assumptions of analysis of variance.

5.5 "03" series of breeding lines

5.5.1 Background

Breeding lines of the "03" series from the DPIVAF-PBP were tested. One unreplicated screening was completed and fresh market and crisp selections are described below.

5.5.2 Virus testing of breeding lines from DPIVAF-PBP 2005

It is a WA quarantine requirement that tubers of breeding lines from the DPIVAF-PBP be tested and found free of potato virus Y. Only PVY free tubers can be planted in WA. The potato breeding lines selected at from DPIVAF-PBP at Toolangi in 2005 were tested by AGWEST Plant Laboratories (laboratory samples 06/1199 to 06/1380) for potato virus Y as well as for potato virus S, potato virus X, potato leafroll virus and tomato spotted wilt virus. No virus was found in any sample. The test sample number for each breeding line is shown in Tables 5.5.3a, 5.5.4a and 5.5.5.

5.5.3 November 2005 planted unreplicated ware screening at Margaret River.

Aims

1 To select entries suitable for the fresh market in a November planting at Margaret River. The entries comprise three "02" series of DPIVAF-PBB breeding lines plus 117 of the "03" series. These were compared with the standard varieties; Coliban, Delaware, Desiree, Mondial, Nadine, Ruby Lou and White Star.
2 To provide high quality seed for further tests.

Results

The screening grew well with none of the spindly shoots seen in last year's unreplicated screening (Dawson & Mortimore 2005). 117 entries were classified as fresh domestic market types (Table 5.5.3a). Selections had suitable or questionable tuber characteristics with specific gravity greater than 1.055 with after-cooking-darkening less than 2.5 and sloughing less than 2 and fry colour lighter than 8. Selections are shown in bold typeface in Table 5.5.3a. 16 selections were made for further testing in next season's replicated screening.

The main faults causing rejection of entries were:

- unsuitable tuber characteristics which accounted for 50% of rejections
- too severe after-cooking-darkening which accounted for 25% of rejections,
- low specific gravity which accounted for 4% of rejections,
- sloughing which accounted for 4% of rejections.

Table 5.5.3a. Virus test number, tuber characteristics, yield and quality of ware potato breeding lines in a November 2005 planted unreplicated screening at Margaret River. Selections shown in bold.

Entry	Virus free test no.†	TC*	SG	Yield >80g (t/ha)	Quality			Final selection & notes
					Crisp# colour	ACD	Slough	
Selection criteria								
		? or yes	> 1.055	-	< 8	≤ 2.5	≤ 2	
Coliban	1379 1380	yes	1.071	58.3	*	3.5	1.5	Standard, ACD to high
Delaware	WACS	no	1.074	66.2	*	3.5	1.5	Standard, tc unsuitable, ACD too high
Desiree	1375 1376	no	1.080	54.1	*	1.5	1.0	Standard, tc unsuitable
Mondial	WACS	yes	1.069	63.7	*	3.5	1.5	Standard, ACD too high
Nadine	WACS	yes	1.050	40.3	*	1.5	1.0	Standard, low SG
Ruby Lou	**WACS**	**yes**	**1.077**	**44.0**	*	**2.5**	**1.0**	**Standard, selected**
White Star	WACS	yes	1.076	57.6	*	3.5	1.0	Standard, ACD too high
02-1-1	1199	yes	1.086	56.9	5.0	3.0	2.0	No, ACD too high
02-18-2	1200	**yes**	**1.065**	**57.9**	*	**2.5**	**1.5**	**Selected**
02-80-6	1205	**yes**	**1.076**	**8.5**	*	**2.0**	**1.5**	**Selected**
03-3-5	1210	no	1.095	41.0	*	*	*	No, tc unsuitable
03-3-6	1211	yes	1.092	43.1	5.0	3.0	2.5	No, ACD & slough too high
03-4-1	**1212**	**yes**	**1.092**	**33.3**	**5.0**	**2.5**	**1.0**	**Selected**
03-4-2	1213	no	1.078	1.3	*	*	*	No, tc unsuitable
03-4-6	1214	yes	1.075	52.0	5.0	3.0	1.0	No, ACD too high
03-4-11	**1217**	**?**	**1.067**	**28.5**	*	**1.5**	**1.0**	**Selected**
03-6-2	1225	?	1.084	11.3	5.0	3.0	3.5	No, ACD & slough too high
03-6-4	**1226**	**?**	**1.088**	**42.3**	**4.0**	*	*	**Selected**
03-6-8	1229	no	1.063	9.0	*	*	*	No, tc unsuitable
03-9-1	1241	yes	1.062	29.3	6.0	3.0	1.0	No, ACD too high
03-9-2	1242	no	1.055	30.7	*	*	*	No, tc unsuitable
03-9-4	1243	no	1.061	19.5	*	*	*	No, tc unsuitable
03-9-6	1244	yes	1.066	23.2	*	3.5	1.5	No, ACD too high
03-9-7	1245	yes	1.074	43.5	6.0	3.5	1.5	No, ACD too high
03-12-3	1246	yes	1.079	52.6	6.0	2.0	2.5	No, slough too high
03-12-4	**1247**	**?**	**1.073**	**68.6**	**6.0**	**2.5**	**1.5**	**Selected**
03-12-8	**1248**	**yes**	**1.060**	**46.4**	**7.0**	**2.5**	**1.0**	**Selected**
03-13-4	1249	yes	1.078	46.9	6.0	4.5	2.0	No, ACD too high
03-13-6	1250	no	1.072	34.3	*	*	*	No, tc unsuitable
03-13-9	1251	no	1.093	37.7	*	*	*	No, tc unsuitable
03-16-6	1252	no	1.058	15.6	*	*	*	No, tc unsuitable
03-16-7	1253	no	1.072	19.3	*	*	*	No, tc unsuitable
03-16-9	1254	no	1.063	7.6	*	*	*	No, tc unsuitable
03-18-1	1256	no	1.072	23.1	*	*	*	No, tc unsuitable
03-18-3	1258	no	1.070	21.8	*	*	*	No, tc unsuitable
03-18-4	**1259**	**yes**	**1.073**	**40.1**	*	**2.0**	**1.5**	**Selected**
03-19-1	1261	yes	1.048	56.9	*	2.5	1.0	No, SG too low
03-19-7	1262	yes	1.068	40.5	6.0	4.0	1.0	No, ACD too high
03-19-8	1263	?	1.052	37.3	7.0	2.0	1.0	No, SG too low

† AgWest Plant laboratories 2006 sample number. Full number = 06/xxxx. WACS = WA certified seed
* TC = tuber characteristics; yes = suitable, ? = questionable, no = unsuitable
# Crisp colour; scale 1 - 10 (light to dark), >7 unacceptable for French-fries.
+ Boiling: ACD (after-cooking-darkening): 1 = nil, 2 = slight, 3 = moderate, 4 = severe, 5=general blackening

Sloughing: 1 = nil, 2 = slight, 3 = moderate, 4 = severe, 5 = soupy

Table 5.5.3a continued. Virus test number, tuber characteristics, yield and quality of ware potato breeding lines in an November 2005 planted unreplicated screening at Margaret River. Selections shown in bold.

Entry	Virus free test no.†	TC*	SG	Yield >80g (t/ha)	Quality			Final selection & notes
					Crisp# colour	ACD	Slough	
Selection criteria								
		? or yes	> 1.055	-	< 8	≤ 2.5	≤ 2	
Nadine	WACS	yes	1.050	40.3	*	1.5	1.0	Standard (didn't meet criteria)
Ruby Lou	WACS	yes	1.077	44.0	*	2.5	1.0	Standard, selected
03-19-9	1264	?	1.055	25.1	7.0	3.0	1.0	No, ACD too high
03-19-15	1267	yes	1.048	17.8	*	2.0	1.0	No, SG too low
03-19-17	1268	yes	1.053	77.9	*	3.5	1.0	No, SG too low, ACD too hi
03-19-18	**1269**	**yes**	**1.057**	**57.3**	*	**1.5**	**1.0**	**Selected**
03-19-19	1270	yes	1.050	15.3	*	1.0	1.0	No, SG too low
03-19-20	**1271**	**yes**	**1.069**	**46.2**	**6.0**	**2.5**	**1.0**	**Selected**
03-27-7	1276	no	1.068	30.3	*	*	*	No, tc unsuitable
03-27-11	1277	no	1.071	20.5	*	*	*	No, tc unsuitable
03-28-2	**1278**	**yes**	**1.069**	**29.7**	**7.0**	**2.5**	**1.5**	**Selected**
03-30-16	1279	no	1.072	26.8	*	*	*	No, tc unsuitable
03-32-5	1280	no	1.069	29.9	*	*	*	No, tc unsuitable
03-33-7	1281	no	1.078	21.7	*	*	*	No, tc unsuitable
03-33-11	1282	yes	1.063	27.7	*	3.0	1.5	No, ACD too high
03-35-4	1283	no	1.078	33.4	*	*	*	No, tc unsuitable
03-39-1	1284	no	1.072	36.6	*	*	*	No, tc unsuitable
03-41-04	1285	no	1.071	15.7	*	*	*	No, tc unsuitable
03-43-02	1286	**yes**	**1.073**	**40.6**	**7.0**	**2.0**	**1.0**	**Selected**
03-44-4	1287	no	1.072	30.3	*	*	*	No, tc unsuitable
03-44-9	1288	no	1.078	34.3	*	*	*	No, tc unsuitable
03-44-10	1289	no	1.076	27.9	*	*	*	No, tc unsuitable
03-46-14	1291	**yes**	**1.070**	**32.9**	**4.0**	**1.5**	**1.5**	**Selected**
03-47-1	1292	**yes**	**1.072**	**44.8**	*	**2.0**	**2.0**	**Selected**
03-49-1	1293	no	1.083	24.1	*	*	*	No, tc unsuitable
03-49-4	1294	yes	1.088	25.5	6.0	4.0	1.0	No, ACD too high
03-49-8	1295	?	1.072	3.2	*	4.0	1.0	No, ACD too high
03-49-13	1296	?	1.080	42.3	*	3.5	3.5	No, ACD & slough too high
03-49-15	1297	no	1.075	23.6	*	*	*	No, tc unsuitable
03-50-3	1299	no	1.077	45.7	*	*	*	No, tc unsuitable
03-51-4	1302	no	1.075	1.5	*	*	*	No, tc unsuitable
03-51-5	1303	yes	1.058	12.5	*	3.0	1.0	No, ACD too high
03-51-6	1304	yes	1.060	35.1	*	4.0	1.0	No, ACD too high
03-51-8	1305	no	1.061	8.0	*	*	*	No, tc unsuitable
03-51-10	1306	yes	1.065	33.9	*	4.5	1.0	No, ACD too high
03-51-12	1307	no	1.061	5.5	*	*	*	No, tc unsuitable
03-51-22	1308	yes	1.060	29.9	5.0	3.5	1.5	No, ACD too high

† AgWest Plant laboratories 2006 sample number. Full number = 06/xxxx. WACS = WA certified seed

* TC = tuber characteristics; yes = suitable, ? = questionable, no = unsuitable

Crisp colour; scale 1 - 10 (light to dark), >7 unacceptable for French-fries.

+ Boiling: ACD (after-cooking-darkening): 1 = nil, 2 = slight, 3 = moderate, 4 = severe, 5=general blackening
Sloughing: 1 = nil, 2 = slight, 3 = moderate, 4 = severe, 5 = soupy

Table 5.5.3.a continued. Virus test number, tuber characteristics, yield and quality of ware potato breeding lines in an November 2005 planted unreplicated screening at Margaret River. Selections shown in bold.

Entry	Virus Free Test no.†	TC*	SG	Yield >80g (t/ha)	Quality			Final selection & notes
					Crisp# colour	ACD	Slough	
Selection criteria								
		? or yes	> 1.055	-	< 8	≤ 2.5	≤ 2	
Nadine	WACS	yes	1.050	40.3	*	1.5	1.0	Standard (didn't meet criteria)
Ruby Lou	WACS	yes	1.077	44.0	*	2.5	1.0	Standard, selected
03-52-3	1309	no	1.063	5.3	*	*	*	No, tc unsuitable
03-52-4	1310	no	1.067	33.5	*	*	*	No, tc unsuitable
03-52-8	1311	no	1.071	23.6	*	*	*	No, tc unsuitable
03-52-15	1312	no	1.061	3.7	*	*	*	No, tc unsuitable
03-52-16	1313	no	1.061	15.2	*	*	*	No, tc unsuitable
03-54-1	1314	no	1.063	34.9	*	*	*	No, tc unsuitable
03-54-2	1315	no	1.070	29.5	*	*	*	No, tc unsuitable
03-54-3	1316	no	1.069	43.5	*	*	*	No, tc unsuitable
03-54-4	1317	no	1.059	53.9	*	*	*	No, tc unsuitable
03-55-2	**1318**	**yes**	**1.058**	**35.7**	**7.0**	**1.5**	**1.0**	**Selected**
03-56-2	1319	no	1.070	24.6	*	*	*	No, tc unsuitable
03-56-3	**1320**	**yes**	**1.074**	**26.0**	**7.0**	**1.5**	**1.5**	**Selected**
03-56-5	1321	no	1.067	50.8	*	*	*	No, tc unsuitable
03-57-3	1324	no	1.060	36.9	*	*	*	No, tc unsuitable
03-57-5	1325	no	1.062	47.5	*	*	*	No, tc unsuitable
03-59-1	1326	no	1.067	25.1	*	*	*	No, tc unsuitable
03-60-10	1327	yes	1.087	26.7	*	4.5	2.0	No, ACD too high
03-63-9	1329	no	1.069	8.7	*	*	*	No, tc unsuitable
03-65-1	1332	yes	1.068	21.2	7.0	4.0	1.0	No, ACD too high
03-67-5	1336	yes	1.064	47.5	*	4.5	2.0	No, ACD too high
03-67-16	1337	no	1.070	13.9	*	*	*	No, tc unsuitable
03-69-1	1342	no	1.076	6.9	*	*	*	No, tc unsuitable
03-69-3	1343	yes	1.067	28.9	*	3.0	1.0	No, ACD too high
03-69-4	1344	no	1.083	26.5	*	*	*	No, tc unsuitable
03-69-5	1345	no	1.068	18.1	*	*	*	No, tc unsuitable
03-69-11	1346	no	1.075	43.3	*	*	*	No, tc unsuitable
03-69-17	1347	no	1.077	21.7	*	*	*	No, tc unsuitable
03-69-18	1348	no	1.070	17.9	*	*	*	No, tc unsuitable
03-69-23	1349	no	1.081	23.9	*	*	*	No, tc unsuitable
03-70-1	1350	yes	1.068	41.7	*	3.0	2.5	No, ACD & slough too high
03-70-10	1351	no	1.088	40.7	*	*	*	No, tc unsuitable
03-70-25	1352	no	1.089	45.6	*	*	*	No, tc unsuitable
03-71-1	1353	no	1.058	22.8	*	*	*	No, tc unsuitable
03-71-13	1354	no	1.071	48.1	*	*	*	No, tc unsuitable

† AgWest Plant laboratories 2006 sample number. Full number = 06/xxxx. WACS = WA certified seed

* TC = tuber characteristics; yes = suitable, ? = questionable, no = unsuitable

Crisp colour; scale 1 - 10 (light to dark), >7 unacceptable for French-fries.

+ Boiling: ACD (after-cooking-darkening): 1 = nil, 2 = slight, 3 = moderate, 4 = severe, 5=general blackening
Sloughing: 1 = nil, 2 = slight, 3 = moderate, 4 = severe, 5 = soupy

Table 5.5.3a continued. Virus test number, tuber characteristics, yield and quality of ware potato breeding lines in an November 2005 planted unreplicated screening at Margaret River. Selections shown in bold.

Entry	Virus free test no.†	TC*	SG	Yield >80g (t/ha)	Quality			Final selection & notes
					Crisp# colour	ACD	Slough	
Selection criteria								
		? or yes	> 1.055	-	< 8	≤ 2.5	≤ 2	
Nadine	WACS	yes	1.050	40.3	*	1.5	1.0	Standard
Ruby Lou	WACS	yes	1.077	44.0	*	2.5	1.0	Standard, selected
03-79-1	1355	no	1.073	36.0	*	*	*	No, tc unsuitable
03-79-2	1356	no	1.056	16.3	*	*	*	No, tc unsuitable
03-79-7	1357	yes	1.070	67.1	5.0	4.0	1.0	No, ACD too high
03-80-3	1358	no	1.056	16.5	*	*	*	No, tc unsuitable
03-80-4	1359	no	1.068	13.2	*	*	*	No, tc unsuitable
03-80-5	1360	no	1.065	46.8	*	*	*	No, tc unsuitable
03-80-6	1361	yes	1.061	56.1	*	3.0	1.0	No, ACD too high
03-80-8	1362	no	1.071	24.9	*	*	*	No, tc unsuitable
03-80-9	1363	no	1.061	37.1	*	*	*	No, tc unsuitable
03-80-10	1364	no	1.055	18.6	*	*	*	No, tc unsuitable
03-80-13	1366	no	1.053	10.2	*	*	*	No, tc unsuitable, low SG
03-80-16	1368	no	1.058	24.1	*	*	*	No, tc unsuitable
03-80-25	1369	no	1.062	10.7	*	*	*	No, tc unsuitable
03-80-26	1370	no	1.060	23.3	*	*	*	No, tc unsuitable
03-81-10	1371	no	1.070	35.1	*	*	*	No, tc unsuitable
03-85-19	1372	no	1.069	17.9	*	*	*	No, tc unsuitable

† AgWest Plant laboratories 2006 sample number. Full number = 06/xxxx. WACS = WA certified seed
* TC = tuber characteristics; yes = suitable, ? = questionable, no = unsuitable
# Crisp colour; scale 1 - 10 (light to dark), >7 unacceptable for French-fries.
+ Boiling: ACD (after-cooking-darkening): 1 = nil, 2 = slight, 3 = moderate, 4 = severe, 5=general blackening
Sloughing: 1 = nil, 2 = slight, 3 = moderate, 4 = severe, 5 = soupy

Entries were screened for SG, ACD and slough before planting (Dawson & Mortimore 2005) using cooking data from the DPIVAF selection plots harvest of 2005. The high number of rejections for moderate and worse ACD indicates that this quality is more severe at Margaret River in WA than at Toolangi, Victoria. Table 5.5.3b shows that for 28 varieties and breeding lines where ACD test data was available from DPIVAF (2005) and DAFWA (2006) 25 had more severe, or darker, ACD at Margaret River than at DPIVAF Toolangi. This shows that strict selection using ACD cooking data from DPIVAF is sound and even stricter selection criteria might be usefully applied.

Selections will be re-tested next season in a replicated screening.

Table 5.5.3b. Comparison of after cooking darkening tests from DPIVAF 2005 and DAFWA 2006.

Entry	ACD tests* DPIVAF 2005†	ACD tests* DAFWA 2006	WA test result compared with DPIVAF	Entry	ACD tests* DPIVAF 2005†	ACD tests* DAFWA 2006	WA test result compared with DPIVAF
Coliban	1.5	3.5	darker	03-18-4	1	2.0	darker
Delaware	1.5	3.5	darker	03-19-7	2	4.0	darker
Desiree	2	1.5	**lighter**	03-19-8	1	2.0	darker
Ruby Lou	1.5	2.5	darker	03-19-9	1	3.0	darker
02-1-1	1	3.0	darker	03-19-20	1	2.5	darker
02-18-2	1	2.5	darker	03-28-2	2	2.5	darker
03-3-6	1	3.0	darker	03-46-14	2	1.5	**lighter**
03-4-1	1	2.5	darker	03-49-4	1	4.0	darker
03-6-2	1	3.0	darker	03-51-5	2	3.0	darker
03-9-7	2	3.5	darker	03-51-22	2	3.5	darker
03-12-3	1	2.0	darker	03-55-2	1	1.5	darker
03-12-4	1	2.5	darker	03-56-3	2	1.5	**lighter**
03-12-8	2	2.5	darker	03-65-1	3	4.0	darker
03-13-4	2	4.5	darker	03-79-7	2	4.0	darker

+ ACD (after-cooking-darkening): 1 = nil, 2 = slight, 3 = moderate, 4 = severe, 5=general blackening
† From Dawson & Mortimore (2005).

5.5.4. November 2005 planted unreplicated crisp screening at Margaret River.

Aims

1 To select entries suitable for the crisp market in a November planting at Margaret River. The entries comprise one "02" series of DPIVAF-PBB breeding lines plus 41 of the "03" series. These were compared with the standard variety Atlantic and the new variety Bliss.
2 To produce high quality seed for further tests.

Results

The screening grew as reported in Section 5.5.3. 42 entries were classified as crisp types (Table 5.5.4a). Selections had suitable or questionable tuber characteristics with specific gravity greater than 1.082 with crisp fry colour less than 6.0. Selections are shown in bold typeface in Table 5.5.4a. Ten breeding lines were selected for further testing in next season's replicated screening.

The main faults causing rejection of entries were low specific gravity which accounted for 23 out of 32 or 72% of rejections, then unsuitable tuber characteristics which accounted for 19 out of 32 or 59% of rejections.

Table 5.5.4a. Virus test number, tuber characteristics, yield and quality of crisp potato breeding lines in a November 2005 planted unreplicated screening at Margaret River. Selections in bold.

Entry	Virus† free test no.	TC*	SG	Yield >80g (t/ha)	Quality			Final selection & notes
					Crisp# colour	ACD	Slough	
Selection criteria								
		? or yes	> 1.082	-	< 6			
Atlantic	1374	**yes**	**1.084**	**40**	**4.0**	*	*	**Yes**
Bliss	WACS	**yes**	**1.101**	**66**	**5.0**	*	*	**Yes**
Ruby Lou	WACS	yes	1.077	44	*	2.5	1.0	No, low SG
02-1-1	1199	**yes**	**1.086**	**57**	**5.0**	**3.0**	**2.0**	**Yes**
03-1-2	1208	**?**	**1.083**	**21**	**4.0**	*	*	**Yes**
03-3-3	1209	no	1.081	28	*	*	*	No, unsuitable tc & low SG
03-3-5	1210	no	1.095	41	*	*	*	No, unsuitable tc
03-4-6	1214	yes	1.075	52	5.0	3.0	1.0	No, low SG
03-4-8	1215	yes	1.078	40	5.0	*	*	No, low SG
03-4-10	**1216**	**yes**	**1.090**	**67**	**5.0**	*	*	**Yes**
03-5-15	1218	no	1.096	10	*	*	*	No, unsuitable tc
03-5-22	1220	no	1.081	31	*	*	*	No, unsuitable tc & low SG
03-5-23	1221	no	1.101	76	*	*	*	No, unsuitable tc
03-5-24	1222	no	1.078	24	*	*	*	No, unsuitable tc & low SG
03-5-26	**1224**	**?**	**1.092**	**28**	**5.0**	*	*	**Yes**
03-6-2	**1225**	**?**	**1.084**	**11**	**5.0**	**3.0**	**3.5**	**Yes**
03-6-5	1227	?	1.078	35	4.0	*	*	No, low SG
03-6-6	1228	no	1.083	18	*	*	*	No, unsuitable tc
03-6-8	1229	no	1.063	9	*	*	*	No, unsuitable tc & low SG
03-7-3	1230	**yes**	**1.086**	**56**	**5.0**	*	*	**Yes**
03-7-4	1231	yes	1.072	23	4.0	*	*	No, low SG
03-7-5	1232	no	1.093	37	*	*	*	No, unsuitable tc
03-7-6	1233	yes	1.067	31	5.0	*	*	No, low SG
03-7-9	1234	no	1.088	26	*	*	*	No, unsuitable tc
03-7-15	1235	?	1.082	28	5.0	*	*	No, low SG
03-7-18	1236	no	1.088	14	*	*	*	No, unsuitable tc
03-7-21	1237	no	1.101	15	*	*	*	No, unsuitable tc
03-7-22	**1238**	**?**	**1.106**	**15**	**5.0**	*	*	**Yes**
03-7-25	**1239**	**?**	**1.088**	**32**	**5.0**	*	*	**Yes**
03-7-27	**1240**	**yes**	**1.085**	**24**	**5.0**	*	*	**Yes**
03-9-1	1241	yes	1.062	29	6.0	3.0	1.0	No, low SG
03-12-3	1246	yes	1.079	53	6.0	2.0	2.5	No, low SG
03-12-4	1247	?	1.073	69	6.0	2.5	1.5	No, low SG
03-12-8	1248	yes	1.060	46	7.0	2.5	1.0	No, low SG & dk fry colour
03-17-1	1255	yes	1.077	22	4.0	*	*	No, low SG
03-19-10	1265	no	1.059	34	*	*	*	No, unsuitable tc & low SG
03-19-14	1266	no	1.052	40	*	3.5	1.0	No, unsuitable tc & low SG
03-20-2	1273	?	1.080	25	5.0	*	*	No, low SG
03-21-10	**1274**	**yes**	**1.088**	**42**	**4.0**	*	*	**Yes**
03-43-02	1286	yes	1.073	41	7.0	2.0	1.0	No, low SG & dk fry colour
03-51-4	1302	no	1.075	1	*	*	*	No, unsuitable tc & low SG
03-51-8	1305	no	1.061	8	*	*	*	No, unsuitable tc & low SG
03-51-12	1307	no	1.061	5	*	*	*	No, unsuitable tc & low SG
03-80-13	1366	no	1.053	10	*	*	*	No, unsuitable tc & low SG
03-80-25	1369	no	1.062	11	*	*	*	No, unsuitable tc & low SG

† AGWEST Plant laboratories 2006 sample number. Full number = 06/xxxx. WACS = WA certified seed

* TC = tuber characteristics; yes = suitable, ? = questionable, no = unsuitable

Crisp colour; scale 1 - 10 (light to dark), >7 unacceptable for French-fries.

+ Boiling: ACD (after-cooking-darkening): 1 = nil, 2 = slight, 3 = moderate, 4 = severe, 5=general blackening

Sloughing: 1 = nil, 2 = slight, 3 = moderate, 4 = severe, 5 = soupy

Entries were screened for SG and fry colour before planting (Dawson & Mortimore 2005) using cooking data from the DPIVAF selection plots harvest of 2005. The high number of rejections for low specific gravity indicates that the WA potato industry requires breeding lines with higher specific gravity than is acceptable in the eastern states. Table 5.5.4b shows that for 18 crisp breeding lines selected for testing in WA where specific gravity data was available from DPIVAF (2005) and DAFWA (2006) 15 had lower specific gravity at Margaret River than at DPIVAF Toolangi. Specific gravity was converted to dry matter and a comparison made which showed that on average the WA test was only 90% of the dry matter test result done in Victoria. This shows that strict selection using specific gravity cooking data from DPIVAF is sound and even stricter selection criteria might be usefully applied.

Selections will be re-tested next season in a replicated screening.

Table 5.5.4b Comparison of specific gravity tests from DPIVAF 2005 and DAFWA 2006

Entry	DPIVAF 2005 tests		DAFWA 2006 tests		WA/DPIVAF
	SG	Dry matter (%)†	SG	Dry matter (%)†	(%)
Atlantic	1.097	23.8	1.084	21.1	88
03-1-2	1.103	25.1	1.083	20.8	83
03-3-3	1.096	23.6	1.081	20.4	87
03-3-5	1.104	25.3	1.095	23.4	92
03-5-15	1.100	24.4	1.096	23.6	97
03-5-22	1.104	25.3	1.081	20.4	81
03-5-23	1.106	25.7	1.101	24.6	96
03-5-24	1.091	22.5	1.078	19.8	88
03-5-26	1.109	26.3	1.092	22.7	86
03-6-2	1.100	24.4	1.084	21.1	86
03-6-5	1.088	21.9	1.078	19.8	90
03-6-6	1.091	22.5	1.083	20.8	93
03-7-3	1.102	24.9	1.086	21.5	86
03-7-15	1.098	24.0	1.082	20.6	86
03-7-21	1.101	24.6	1.101	24.6	100
03-7-22	1.114	27.4	1.106	25.7	94
03-7-25	1.100	24.4	1.088	21.9	90
03-17-1	1.096	23.6	1.077	19.6	83
03-21-10	1.088	21.9	1.088	21.9	100
Average					90

† DM = 24.182 + (211.04*(SG-1.0988)) from Burton (1989).

5.5.5. November 2005 planted unreplicated multi-purpose French fry screening at Margaret River.

Aims

1 To select entries suitable for both the French fry and fresh market in a November planting at Margaret River. The entries comprise one "02" series of DPIVAF-PBB breeding lines plus 41 of the "03" series. These were compared with the standard variety Russet Burbank.

2. To produce high quality seed for further tests.

Results

The screening grew well as reported in Section 5.5.3. 16 entries were classified as French fry types (Table 5.5.5). Selections had suitable tuber characteristics with specific gravity greater than or equal to 1.075 with crisp fry colour less than 7.0. Selections are shown in bold typeface in Table 5.5.5. Only one breeding line was selected for further testing in next season's replicated screening.

The main faults causing rejection of entries were unsuitable tuber characteristics.

Table 5.5.5. Virus test number, tuber characteristics, yield & quality of French fry potato breeding lines in a November 2005 planted unreplicated screening at Margaret River. Selections in bold.

Entry	Virus† free test no.	TC*	SG	Yield >80g (t/ha)	Cook tests (DPIVAF 2005) Crisp# colour	ACD	Slough	Final selection & notes
Selection criteria		yes	≥1.075		≤7.0	≤2.5	≤2.0	
Delaware	WACS	no	1.074	66	*	3.5	1.5	No, unsuitable tc, low SG
Russet Burbank	1377 1378	no	1.086	38	6.0	*	*	No, unsuitable tc
02-35-29	Replant -ed from last yr	no	1.070	49	*	*	*	No, unsuitable tc, low SG
03-18-2	1257	no	1.078	3	*	*	*	No, unsuitable tc
03-46-2	1290	no	1.088	49	*	*	*	No, unsuitable tc
03-60-10	1327	yes	1.087	27	*	4.5	2.0	No, ACD
03-60-17	1328	no	1.088	3	*	*	*	No, unsuitable tc
03-63-9	1329	no	1.069	9	*	*	*	No, unsuitable tc, low SG
03-64-8	1330	yes	1.071	55	4.0	3.5	2.5	No, low SG & ACD
03-64-9	1331	no	1.083	4	*	*	*	No, unsuitable tc
03-66-1	1333	no	1.065	18	*	*	*	No, unsuitable tc, low SG
03-66-3	**1334**	**yes**	**1.078**	**28**	*	**2.0**	**2.5**	**Yes,**
03-67-22	1338	no	1.082	43	*	*	*	No, unsuitable tc
03-68-1	1339	no	1.078	13	*	*	*	No, unsuitable tc
03-68-5	1340	no	1.095	40	*	*	*	No, unsuitable tc
03-68-7	1341	no	1.070	28	*	*	*	No, unsuitable tc, low SG
03-69-1	1342	no	1.076	7	*	*	*	No, unsuitable tc
03-69-5	1345	no	1.068	18	*	*	*	No, unsuitable tc, low SG

† AGWEST Plant laboratories 2006 sample number. Full number = 06/xxxx. WACS = WA certified seed
* TC = tuber characteristics; yes = suitable, ? = questionable, no = unsuitable
# Crisp colour; scale 1 - 10 (light to dark), >7 unacceptable for French-fries.
+ Boiling: ACD (after-cooking-darkening): 1 = nil, 2 = slight, 3 = moderate, 4 = severe, 5=general blackening
Sloughing: 1 = nil, 2 = slight, 3 = moderate, 4 = severe, 5 = soupy

5.6 "04" Series of breeding lines

5.6.1. Revision of project priorities by the project advisory committee

Since 2003 the priority set for the variety evaluation project for the fresh potato market in WA has been the development of a variety that will improve sustainability of winter potato production. The prospect that White Star will fill the WA potato industry's requirement for an improved winter variety (see Section 5.2.2) means that new priorities will need to be considered.

The "04"series of breeding lines will be grown in WA in October 2006 and selection criteria applied should match new priorities. Priority setting is done by the projects advisory committee. The Advisory committee membership is as follows:

- Dave Anderson, Potato Growers Association (PGA) Vice President & Metropolitan Zone Chairman,
- Peter Dawson, DAFWA,
- Larry Hegarty, A/Supply Manager, PMCWA,
- Anthony Marinovich, PGA Myalup Zone Chairman,
- Jeff Mortimore, DAFWA, and
- Paul Tempra, PGA Manjimup Zone Chairman.

The advisory committee discussed industry priorities during a telephone conference held on 30 May 2006. John Dawson, the new CEO of the PMCWA, attended as an observer. DAFWA representatives presented a summary of the last four years work of variety evaluation. The main points were that:

- Experiments showed White Star and Maris Piper offered improvements over standard varieties winter.
- Four years of commercial testing by industry (Western Potatoes, selected growers and DAFWA) confirmed the experimental results and showed that White Star was preferred by growers and packers.
- Maris Piper was also considered to be a useful variety for winter production.

It was proposed that the variety evaluation work could stop concentrating on the metropolitan zone and concentrate on looking for an alternative variety to Nadine for summer cropping. This variety would have to have the cosmetic appeal of Nadine but improved culinary qualities of improved taste, versatility while maintaining Nadine's tolerance to blemish diseases and after-cooking-darkening (ACD).

The advisory committee decided that this was an appropriate suitable way to proceed. The testing program should ensure that:

- ACD tolerance should be a high priority,
- Taste testing should be maintained although the PMC was happy for DAFWA to do this.
- PMC undertook to speed up the availability of improved varieties through accelerated seed supply for commercial tests.

The project will continue to look for improved crisp breeding lines for the export market in fresh potatoes that in (2004/05) was valued at FOB $8.6 million the 18,537 tonnes exported (Mattingley 2006).

5.6.2. Selection of "04" series of breeding lines from DPIVAF-PBP 2006

5.6.2.1. Selection criteria used at DPIVAF-PBP for WA selections

Selection criteria have been discussed in Section 4.4 and in the previous Section. The summer grown selection plots at the DPIVAF-PBP allow selection for resistance to blemish diseases (silver scurf and black dot), low after-cooking-darkening, versatile cooking quality and attractive appearance. For the export crisp market improvements over Atlantic in yield and quality are needed. Quality attributes include shape, eye depth, specific gravity, fry colour and internal disorders.

In May 2006 the amount of material available to WA for selection had declined markedly to about 300 breeding lines instead of the 1,500 that had been available previously. The Fresh Breeding Program is currently under review by HAL. How the breeding program can be used to greater effect through customised crosses for WA should be investigated.

Selections for the crisp market are shown in Table 5.6.2a. 90 crisp breeding lines were selected in the field from 18 crosses by staff from WA and the DPIVAF-PBP. Note that some of breeding lines were selected for both fresh and crisp markets. When cooking performance was taken into account the selections were reduced to 45. Those lines with specific gravity less than 1.080 and fry colour score of 7 or darker were rejected.

Selections for the fresh market are shown in Table 5.6.2b. 110 fresh breeding lines were selected in the field from 28 crosses by staff from WA and the DPIVAF-PBP. When cooking performance was taken into account the selections were reduced to 58. Those rejected had specific gravity less than 1.065, fry colour greater than 6, or ACD and sloughing greater than 2.

French fry selections are shown in Table 5.6.2c. Ten breeding lines from nine crosses were selected in the field. These were mainly French fry types that had outstanding tuber characteristics and were considered to be worth testing in WA for the small French fry industry. After cooking data was considered, four were selected for further testing.

Other selections are shown in Table 5.6.2d. Three breeding lines from three crosses were selected. These were mainly novelty types that had unusual features and were considered to be worth testing in WA for the ware industry. After cooking data was considered one was selected for further testing.

Table 5.6.2a. Crisp selections for WA from G2 selection plots harvested at DPIVAF-PBP in April 2006. Primary selection based on crosses (parents shown) and tuber characteristics. Final selection based on cooking quality.

Breeding line	Mat-* urity	Selected by	Spec. gravity	Fry† colour	Boiling tests‡ Colour	ACD	Slough	Plots	WA use~	Comments	WA final selection
Selection criteria: →			≥ 1.080	<7							
Standard variety											
Atlantic	M		1.075	5	2	1	2	Arn G2	c		
Astra x 93-6-3								Arn G2			
04-122-1	L	WA	1.086	5	3	1	2	Arn G2	c	Good size	Yes c
04-122-3	ML	WA	1.085	5	3	2	2	Arn G2	c	Larger ones can be oblong	Yes c
Lady Rosetta x Crispa											
04-131-2	ML	WA	1.109	3	4	1	2	Arn G2	c		Yes c
04-131-5	ML	WA	1.090	5	4	1	3	Arn G2	cw	Bigger ones tend to be oblong – skin too netted for ware? Slough too high	Yes c
Argos x Ruby Lou											
04-170-6	L	WA	1.069	9	2	2	2	W G2	wc	it might be a crisp SG too low, fry too dark	No c
04-170-9	M		1.073	7	4	1	2	W G2	wc	best for crisp – no blemish but textured SG too low	No c
04-170-10	M		1.070	3	4	1	2	W G2	wc	lilac skin – best for crisp SG too low	No c
04-170-14	M		1.078	6	2	2	2	W G2	wc	Skin too textured SG too low	No c
04-170-15	ME		1.068	3	3	1	1	W G2	wc	Skin too textured SG too low	No c
04-170-19	M		1.076	6	3	1	2	W G2	c/Ff	Mostly round but some oblongs SG too low	No c
04-170-20	ML		1.087	4	3	1	3	W G2	c		Yes c
04-170-21	M	WA	1.076	6	3	1	3	W G2	wc	SG too low	No c
04-170-25	ME		1.069	8	2	1	2	W G2	wc	Best for crisp – skin too netted SG too low, fry too dark	No c
Crystal x Wilwash											
04-171-6	VL	WA	1.061	4	2	1	1	W G2	wc	A bit ugly but nice skin SG too low	No c

* Maturity, E = early, M = mid, L = late, V = very

† Fry colour: visually assessed on scale 1 - 10 (light to dark), <7 acceptable for crisp processing.

‡ Boiling tests: col = flesh colour

@ ACD (after-cooking-darkening): 1 = nil, 2 = slight, 3 = moderate, 4 = severe, 5=general blackening

~ Sloughing: 1 = nil, 2 = slight, 3 = moderate, 4 = severe, 5 = soupy.

~use: c = crisp, Ff = French fry, w = ware (fresh), g'met = gourmet, ? = questionable, + = very good

Table 5.6.2a continued. Crisp selections for WA from selection plots harvested at DPIVAF-PBP in April 2006. Primary selection based on crosses (parents shown) and tuber characteristics. Final selection based on cooking quality.

Breeding line	Mat-* urity	Selected by	Spec. gravity	Fry† colour	Boiling tests‡ Col	ACD	Slough	Plots	WA use~	Comments	WA final selection
Selection criteria: →			≥ 1.080	<7							
Crystal x 80-98-09											
04-172-1	ME		1.069	4	2	1	1	W G2	wc	Nice skin – some lenticels – bit ugly too low	No c
04-172-2	M		1.074	4	3	1	2	W G2	wc	Very nice skin – not much blemish – bit ugly SG too low	No c
04-172-3	E	WA	1.074	3	2	1	2	W G2	wc	Some black dot SG too low	No c
04-172-4	M		1.076	4	3	1	3	W G2	wc	A bit flat – not much scurf SG too low	No c
04-172-6	ME		1.070	4	3	1	2	W G2	wc	Nice skin – not much scurf SG too low	No c
04-172-7	ML		1.073	4	2	1	3	W G2	wc	Susceptible to black dot – best for crisp SG too low	No c
04-172-8	M		1.071	4	1	1	2	W G2	wc	Susceptible to black dot – best for crisp SG too low	No c
04-172-9	E		1.059	4	1	1	2	W G2	wc	Brilliant white skin – is it too soft SG too low	No c
04-172-10	M		1.073	6	2	1	1	W G2	wc	Very nice shape SG too low	No c
04-172-13	ML		1.075	3	2	1	2	W G2	wc	Heels and crowns too deep SG too low	No c
04-172-15	ME		1.071	3	2	1	2	W G2	wc	Too ugly and susceptible to scurf SG too low	No c
04-172-16	ME	WA	1.068	4	1	1	3	W G2	wc	Some lenticel – not much scurf – crowns too deep SG too low	No c
04-172-18	VE		1.069	5	3	1	1	W G2	wc	Nice shape – too many smalls – some scurf SG too low	No c
04-172-19	ME		1.080	4	3	1	3	W G2	wc	Best for crisp – scab slough too great for ware	Yes c
04-172-20	M		1.073	4	2	1	3	W G2	wc	A bit ugly - scab SG too low slough too great for ware	No c
04-172-22	ME	WA	1.071	4	2	1	2	W G2	wc	Best for crisp SG too low	No c
04-172-24	M		1.072	3	1	2	2	W G2	wc	Scab – best for crisp SG too low	No c
Crystal x 86-19-1											
04-173-2	E		1.085	3	1	1	1	W G2	wc	Nice skin and shape – a bit small	Yes c

* Maturity, E = early, M = mid, L = late, V = very

† Fry colour: visually assessed on scale 1 - 10 (light to dark), <7 acceptable for crisp processing.

‡ Boiling tests: col = flesh colour

@ ACD (after-cooking-darkening): 1 = nil, 2 = slight, 3 = moderate, 4 = severe, 5=general blackening

~ Sloughing: 1 = nil, 2 = slight, 3 = moderate, 4 = severe, 5 = soupy.

~use: c = crisp, Ff = French fry, w = ware (fresh), g'met = gourmet, ? = questionable, + = very good

Table 5.6.2a continued. Crisp selections for WA from selection plots harvested at DPIVAF-PBP in April 2006. Primary selection based on crosses (parents shown) and tuber characteristics. Final selection based on cooking quality.

Breeding line	Mat-* urity	Selected by	Spec. gravity	Fry† colour	Boiling tests‡ Col	ACD	Slough	Vic use~	WA use~	Comments	WA final selection
Selection criteria: →			≥ 1.080	<7							
Crystal x 93-37-3											
04-174-2	ML		1.080	4	2	1	2	W G2	wc	Too flat for crisp and ware Poor shape	No c
04-174-16	M		1.074	6	2	1	1	W G2	wc	Not much blemish – skin a bit textured – lenticels SG too low	No c
04-174-19	ML		1.077	5	2	1	2	W G2	wc	Lilac blush – looks good – nice skin SG too low	No c
04-174-20	ME	WA	1.074	3	1	1	2	W G2	wc	SG too low	No c
04-174-22	VE		1.070	6	3	1	2	W G2	wc	Too flat - scurf SG too low	No c
04-174-25	ME		1.089	4	2	1	1	W G2	wc	Deep eyes and heels eyes too deep for ware	Yes c
Lady Rossetta x Crispa											
04-175-1	ME	WA	1.088	4	3	1	2	W G2	c		Yes c
04-175-2	E		1.078	3	2	1	2	W G2	c	Too small – good shape SG too low	No c
04-175-4	ME		1.083	5	4	1	2	W G2	c	Pink – yellow flesh – crowns a bit deep	Yes c
04-175-5	M		1.090	3	3	2	2	W G2	c	Pink – great shape	Yes c
04-175-9	ME		1.081	5	2	1	2	W G2	c	Good crisp shape	Yes c
Lustre x Crispa											
04-176-2	M		1.089	4	3	1	4	W G2	wc	Best for crisp slough too great for ware	Yes c
04-176-3	M		1.083	2	2	2	4	W G2	wc	No scurf – best for crisp slough too great for ware	Yes c
04-176-7	ME		1.079	4	2	1	2	W G2	wc	Best for crisp – a bit flat SG too low	No c
04-176-8	ME		1.070	4	3	1	2	W G2	wc	Best for crisp SG too low	No c
04-176-9	ME		1.079	4	3	1	1	W G2	c	SG too low	No c
04-176-11	M		1.083	4	2	1	4	W G2	c	No scurf – a bit ugly but high yield	Yes c

* Maturity, E = early, M = mid, L = late, V = very

† Fry colour: visually assessed on scale 1 - 10 (light to dark), <7 acceptable for crisp processing.

‡ Boiling tests: col = flesh colour

@ ACD (after-cooking-darkening): 1 = nil, 2 = slight, 3 = moderate, 4 = severe, 5=general blackening

~ Sloughing: 1 = nil, 2 = slight, 3 = moderate, 4 = severe, 5 = soupy.

~use: c = crisp, Ff = French fry, w = ware (fresh), g'met = gourmet, ? = questionable, + = very good

Table 5.6.2a continued. Crisp selections for WA from selection plots harvested at DPIVAF-PBP in April 2006. Primary selection based on crosses (parents shown) and tuber characteristics. Final selection based on cooking quality.

Breeding line	Mat-* urity	Selected by	Spec. gravity	Fry† colour	Boiling tests‡ Col	ACD	Slough	Plots	WA use~	Comments	WA final selection
Selection criteria: →			≥ 1.080	<7							
Lustre x Crispa continued											
04-176-12	M	WA	1.089	3	3	1	2	W G2	c	A bit flat	Yes c
04-176-13	ME		1.070	4	2	1	1	W G2	c	SG too low	No c
Oceania x Wilwash											
04-181-1	E	WA	1.068	4	2	1	2	W G2	wc	Nice skin – some scurf SG too low	No c
04-181-6	M		1.069	5	3	1	3	W G2	wc	Skin not that good but good shape SG too low	No c
04-181-12	M		1.077	5	3	1	4	W G2	Wc	Some lenticels SG too low	No c
Onka x Redsen											
04-182-5	VE	WA	1.072	2	3	1	2	W G2	c	Crimson SG too low	No c
04-182-20	ME		1.069	3	3	2	1	W G2	wc	pink SG too low	No c
Pike x Sonic											
04-185-1	M		1.082	4	3	1	2	W G2	wc	Pink eyes – too small	Yes
04-185-3	L		1.089	4	2	2	2	W G2	wc	Pink eyes – too ugly for ware	Yes c
Rosa x Crispa											
04-188-2	L		1.086	4	3	1	3	W G2	c	Eyes and heels a bit deep	Yes c
Snowden x Trent											
04-192-1	E	WA	1.090	2	3	1	2	W G2	c		Yes c
04-192-4	E	WA	1.090	2	2	1	3	W G2	c		Yes c

* Maturity, E = early, M = mid, L = late, V = very

† Fry colour: visually assessed on scale 1 - 10 (light to dark), <7 acceptable for crisp processing.

‡ Boiling tests: col = flesh colour

@ ACD (after-cooking-darkening): 1 = nil, 2 = slight, 3 = moderate, 4 = severe, 5=general blackening

~ Sloughing: 1 = nil, 2 = slight, 3 = moderate, 4 = severe, 5 = soupy.

~use: c = crisp, Ff = French fry, w = ware (fresh), g'met = gourmet, ? = questionable, + = very good

Table 5.6.2a continued. Crisp selections for WA from selection plots harvested at DPIVAF-PBP in April 2006. Primary selection based on crosses (parents shown) and tuber characteristics. Final selection based on cooking quality.

Breeding line	Mat-* urity	Selected by	Spec. gravity	Fry† colour	Boiling tests‡ Col	ACD	Slough	Plots	WA use~	Comments	WA final selection
Selection criteria: →			≥ 1.080	<7							
Sonic x Crispa											
04-195-1	L		1.095	4	3	2	3	W G2	wc	Pink eye and blush	Yes c
04-195-3	ML		1.097	4	3	1	4	W G2	c		Yes c
04-195-4	ML		1.088	4	3	2	2	W G2	wc		Yes c
04-195-5	ML		1.100	4	3	1	3	W G2	c	Too small, large numbers, space out	Yes c
04-195-7	ME		1.093	1	2	1	2	W G2	c	Space out	Yes c
04-195-8	ML		1.106	3	3	3	2	W G2	c		Yes c
04-195-9	VL		1.088	4	3	1	3	W G2	wc	Pink eyes and blush	Yes c
04-195-10	ML		1.084	4	4	1	2	W G2	wc		Yes c
Toolangi Delight x Red Ruby											
04-196-1	L		1.085	4	2	1	2	W G2	wc	purple	Yes c
04-196-2	L		1.084	4	1	1	3	W G2	wc	Purple, heels a bit deep	Yes c
66-11-2 x Wilwash											
04-198-5	ME	WA	1.064	6	3	1	2	W G2	c	Must cook to go on SG too low	No c

* Maturity, E = early, M = mid, L = late, V = very

† Fry colour: visually assessed on scale 1 - 10 (light to dark), <7 acceptable for crisp processing.

‡ Boiling tests: col = flesh colour

@ ACD (after-cooking-darkening): 1 = nil, 2 = slight, 3 = moderate, 4 = severe, 5=general blackening

~ Sloughing: 1 = nil, 2 = slight, 3 = moderate, 4 = severe, 5 = soupy.

~use: c = crisp, Ff = French fry, w = ware (fresh), g'met = gourmet, ? = questionable, + = very good

Table 5.6.2a continued. Crisp selections for WA from selection plots harvested at DPIVAF-PBP in April 2006. Primary selection based on crosses (parents shown) and tuber characteristics. Final selection based on cooking quality.

Breeding line	Mat-* urity	Selected by	Spec. gravity	Fry† colour	Boiling tests‡ Col	ACD	Slough	Plots	WA use~	Comments	WA final selection
Selection criteria: →			≥ 1.080	<7							
86-31-3 x Crispa											
04-201-1	ML		1.088	4	3	1	4	W G2	c		Yes c
04-201-2	M	WA	1.086	3	1	2	3	W G2	c	Too small and ugly but huge yield potential	Yes c
04-201-6	ME		1.087	4	3	1	2	W G2	c	Big ones oblong	Yes c
04-201-8	ML		1.078	4	3	2	1	W G2	c	Looks good, very uniform SG too low	No c
04-201-9	L		1.084	4	2	1	2	W G2	c	Small, flat with oblongs, high yield	Yes c
04-201-10	M		1.081	5	2	1	3	W G2	c	A bit flat	Yes c
04-201-14	ML		1.084	4	3	2	3	W G2	c	Shape and size not uniform, late maturity	Yes c
04-201-15	ME		1.076	3	2	1	2	W G2	c	SG too low	No c
89-88-3 x Crispa											
04-202-2	ML		1.098	2	3	1	4	W G2	c	Pink eyes	Yes c
04-202-3	ML		1.085	4	3	2	4	W G2	c	Slight pink in eye, look out for hollow heart	Yes c
04-202-4	M		1.084	2	3	2	3	W G2	c		Yes c
04-202-5	L		1.104	4	4	1	4	W G2	c	Pink eyes and splash, large numbers	Yes c
04-202-6	ML		1.090	5	3	1	3	W G2	c	Pink eyes, slight splash, shape not that good	Yes c
04-202-7	L		1.077	5	4	1	2	W G2	c	SG too low	No c
04-202-8	VL		1.090	3	4	1	3	W G2	c	Late maturity, large plants	Yes c
04-202-9	ML		1.095	3	4	1	4	W G2	c	Large numbers but too small	Yes c
04-202-11	VL		1.097	4	3	1	3	W G2	c	Late maturity	Yes c
04-202-13	VL		1.081	4	2	1	2	W G2	c		Yes c

* Maturity, E = early, M = mid, L = late, V = very

† Fry colour: visually assessed on scale 1 - 10 (light to dark), <7 acceptable for crisp processing.

‡ Boiling tests: col = flesh colour

@ ACD (after-cooking-darkening): 1 = nil, 2 = slight, 3 = moderate, 4 = severe, 5=general blackening

~ Sloughing: 1 = nil, 2 = slight, 3 = moderate, 4 = severe, 5 = soupy.

~use: c = crisp, Ff = French fry, w = ware (fresh), g'met = gourmet, ? = questionable, + = very good

Table 5.6.2b. Ware selections for WA from selection plots harvested at DPIVAF-PBP in April 2006. Primary selection based on crosses (parents shown) and tuber characteristics. Final selection based on cooking quality.

Breeding line	Mat-* urity	Selected by	Spec. gravity	Fry† colour	Boiling tests‡ Colour	ACD	Slough	Plots	WA use~	Comments	WA final selection
Selection criteria: →			≤1.065	<7		**≤2**	**≤2**				
Standard varieties											
Coliban	L		1.071	5	2	1	3	W G2			
Desiree	ML		1.081	6	4	1	2	W G2			
Catani x Crispa											
04-125-1	ME	WA	1.077	8	2	1	2	Arn G2	w	Not much blemish – some lenticel Fry too dark	No w
Denali x Crispa											
04-129-1	M	WA	1.088	7	2	2	3	Arn G2	w	Not much blemish Slough too high	No w
Lady Rosetta x Crispa											
04-131-5	ML	WA	1.090	5	4	1	3	Arn G2	cw	Bigger ones oblong, skin too netted for ware? Slough too high	No w
Wontscab x Crispa											
04-141-4	E	WA	1.073	3	3	1	2	Arn G2	w/Ff	SG too low for Ff	Yes w
Argos x Ruby Lou											
04-170-6	L	WA	1.069	9	2	2	2	W G2	wc	it might be a crisp, for ware fry too dark	No w
04-170-7	M		1.067	6	3	1	2	W G2	w	purple – colour a bit pale	Yes w
04-170-9	M		1.073	7	4	1	2	W G2	wc	best for crisp – no blemish but textured	Yes w
04-170-10	M		1.070	3	4	1	2	W G2	wc	lilac skin – best for crisp	Yes w
04-170-11	VL	WA	1.064	9	2	1	1	W G2	w	v dk purple, chaining, white eyes, SG too low & fry too dark	No w
04-170-14	M		1.078	6	2	2	2	W G2	wc	Skin too textured For crisp SG needs to be ≥ 1.080	No w
04-170-15	ME		1.068	3	3	1	1	W G2	wc	Skin too textured For crisp SG needs to be ≥ 1.080	No w

* Maturity, E = early, M = mid, L = late, V = very

† Fry colour: visually assessed on scale 1 - 10 (light to dark), <7 acceptable for crisp processing.

‡ Boiling tests: col = flesh colour

@ ACD (after-cooking-darkening): 1 = nil, 2 = slight, 3 = moderate, 4 = severe, 5=general blackening

~ Sloughing: 1 = nil, 2 = slight, 3 = moderate, 4 = severe, 5 = soupy.

~use: c = crisp, Ff = French fry, w = ware (fresh), g'met = gourmet, ? = questionable, + = very good

Table 5.6.2b. Ware selections for WA from selection plots harvested at DPIVAF-PBP in April 2006. Primary selection based on crosses (parents shown) and tuber characteristics. Final selection based on cooking quality.

Breeding line	Mat-* urity	Selected by	Spec. gravity	Fry† colour	Boiling tests‡ Col	ACD	Slough	Plots	WA use~	Comments	WA final selection
Selection criteria: →			≤1.065	<7		**≤2**	**≤2**				
Argos x Ruby Lou continued											
04-170-21	M	WA	1.076	6	3	1	3	W G2	wc	For crisp SG needs to be ≥ 1.080, for ware slough too great	No w
04-170-25	ME		1.069	8	2	1	2	W G2	wc	Best for crisp – skin too netted, for crisp SG needs to be ≥ 1.080, for ware fry too dark	No w
04-170-26	ML		1.080	4	3	1	3	W G2	w/Ff	Pink – not much blemish, slough too great for ware	No w
Crystal x Wilwash											
04-171-1	E	WA	1.063	5	1	1	2	W G2	w	For ware SG too low	No w
04-171-5	E	WA	1.074	4	3	1	2	W G2	w		Yes w
04-171-6	VL	WA	1.061	4	2	1	1	W G2	wc	A bit ugly but nice skin SG too low for ware	No w
Crystal x 80-98-09											
04-172-1	ME		1.069	4	2	1	1	W G2	wc	Nice skin – some lenticels – bit ugly	Yes w
04-172-2	M		1.074	4	3	1	2	W G2	wc	Very nice skin – not much blemish – bit ugly	Yes w
04-172-3	E	WA	1.074	3	2	1	2	W G2	wc	Some black dot	Yes w
04-172-4	M		1.076	4	3	1	3	W G2	wc	A bit flat – not much scurf, for ware slough too great	No w
04-172-6	ME		1.070	4	3	1	2	W G2	wc	Nice skin – not much scurf	Yes w
04-172-7	ML		1.073	4	2	1	3	W G2	wc	Susceptible to black dot – best for crisp, for ware slough too great	No w
04-172-8	M		1.071	4	1	1	2	W G2	wc	Susceptible to black dot – best for crisp, for ware too much black dot	No w
04-172-9	E		1.059	4	1	1	2	W G2	wc	Brilliant white skin – is it too soft, also too low for ware	No w

* Maturity, E = early, M = mid, L = late, V = very

† Fry colour: visually assessed on scale 1 - 10 (light to dark), <7 acceptable for crisp processing.

‡ Boiling tests: col = flesh colour

@ ACD (after-cooking-darkening): 1 = nil, 2 = slight, 3 = moderate, 4 = severe, 5=general blackening

~ Sloughing: 1 = nil, 2 = slight, 3 = moderate, 4 = severe, 5 = soupy.

~use: c = crisp, Ff = French fry, w = ware (fresh), g'met = gourmet, ? = questionable, + = very good

Table 5.6.2b continued. Ware selections for WA from selection plots harvested at DPIVAF-PBP in April 2006. Primary selection based on crosses (parents shown) and tuber characteristics. Final selection based on cooking quality.

Breeding line	Mat-* urity	Selected by	Spec. gravity	Fry† colour	Boiling tests‡ Col	ACD	Slough	Plots	WA use~	Comments	WA final selection
Selection criteria: →			≤1.065	<7		**≤2**	**≤2**				
Standard variety											
Coliban	L		1.071	5	2	1	3	W G2			
Desiree	ML		1.081	6	4	1	2	W G2			
Crystal x 80-98-09 continued											
04-172-10	M		1.073	6	2	1	1	W G2	wc	Very nice shape	Yes w
04-172-13	ML		1.075	3	2	1	2	W G2	wc	Heels and crowns too deep	Yes w
04-172-15	ME		1.071	3	2	1	2	W G2	wc	Too ugly and susceptible to scurf too ugly for ware	No w
04-172-16	ME	WA	1.068	4	1	1	3	W G2	wc	Some lenticel – not much scurf – crowns too deep, slough too great for w	No w
04-172-18	VE		1.069	5	3	1	1	W G2	wc	Nice shape – too many smalls – some scurf	Yes w
04-172-19	ME		1.080	4	3	1	3	W G2	wc	Best for crisp – scab slough too great for ware	No w
04-172-20	M		1.073	4	2	1	3	W G2	wc	A bit ugly - scab slough too great for ware	No w
04-172-22	ME	WA	1.071	4	2	1	2	W G2	wc	Best for crisp	Yes w
04-172-24	M		1.072	3	1	2	2	W G2	wc	Scab – best for crisp	Yes w
04-172-26	M		1.067	5	2	1	3	W G2	w	Nice shape slough too great for ware	No w
04-172-27	M		1.068	4	2	1	1	W G2	w	Scab – nice shape	Yes w
Crystal x 86-19-1											
04-173-2	E		1.085	3	1	1	1	W G2	wc	Nice skin and shape – a bit small	Yes w

* Maturity, E = early, M = mid, L = late, V = very

† Fry colour: visually assessed on scale 1 - 10 (light to dark), <7 acceptable for crisp processing.

‡ Boiling tests: col = flesh colour

@ ACD (after-cooking-darkening): 1 = nil, 2 = slight, 3 = moderate, 4 = severe, 5=general blackening

~ Sloughing: 1 = nil, 2 = slight, 3 = moderate, 4 = severe, 5 = soupy.

~use: c = crisp, Ff = French fry, w = ware (fresh), g'met = gourmet, ? = questionable, + = very good

Table 5.6.2b continued. Ware selections for WA from selection plots harvested at DPIVAF-PBP in April 2006. Primary selection based on crosses (parents shown) and tuber characteristics. Final selection based on cooking quality.

Breeding line	Mat-* urity	Selected by	Spec. gravity	Fry† colour	Boiling tests‡ Col	ACD	Slough	Vic use~	WA use~	Comments	WA final selection
Selection criteria: →			≤1.065	<7		**≤2**	**≤2**				
Standard variety											
Coliban	L		1.071	5	2	1	3	W G2			
Desiree	ML		1.081	6	4	1	2	W G2			
Crystal x 93-37-3											
04-174-1	M		1.080	3	2	2	1	W G2	w	Too flat and bumpy	Yes w
04-174-2	ML		1.080	4	2	1	2	W G2	wc	Too flat for crisp and ware Poor shape	No w
04-174-8	ME			4	1	1	1	W G2	w		Yes w
04-174-10	M		1.073	5	2	1	3	W G2	w	A bit flat – discus – spots slough too great for ware	No w
04-174-16	M		1.074	6	2	1	1	W G2	wc	Not much blemish – skin a bit textured – lenticels	Yes w
04-174-17	ME		1.057	3	2	1	1	W G2	w	SG too low for ware	No w
04-174-19	ML		1.077	5	2	1	2	W G2	wc	Lilac blush – looks good – nice skin	Yes w
04-174-20	ME	WA	1.074	3	1	1	2	W G2	wc		Yes w
04-174-22	VE		1.070	6	3	1	2	W G2	wc	Too flat - scurf	Yes w
04-174-23	M		1.078	5	3	2	2	W G2	w	Good skin – poor shape	Yes w
04-174-24	ML	WA	1.072	8	2	1	2	W G2	w	Good skin – a bit ugly – lilac blush fry too dark for ware	No w
04-174-25	ME		1.089	4	2	1	1	W G2	wc	Deep eyes and heels eyes too deep for ware	No w

* Maturity, E = early, M = mid, L = late, V = very

† Fry colour: visually assessed on scale 1 - 10 (light to dark), <7 acceptable for crisp processing.

‡ Boiling tests: col = flesh colour

@ ACD (after-cooking-darkening): 1 = nil, 2 = slight, 3 = moderate, 4 = severe, 5=general blackening

~ Sloughing: 1 = nil, 2 = slight, 3 = moderate, 4 = severe, 5 = soupy.

~use: c = crisp, Ff = French fry, w = ware (fresh), g'met = gourmet, ? = questionable, + = very good

Table 5.6.2b continued. Ware selections for WA from selection plots harvested at DPIVAF-PBP in April 2006. Primary selection based on crosses (parents shown) and tuber characteristics. Final selection based on cooking quality.

Breeding line	Mat-* urity	Selected by	Spec. gravity	Fry† colour	Boiling tests‡ Col	ACD	Slough	Plots	WA use~	Comments	WA final selection
Selection criteria: →			≤1.065	<7		≤2	≤2				
Standard variety											
Coliban	L		1.071	5	2	1	3	W G2			
Desiree	ML		1.081	6	4	1	2	W G2			
Lustre x Crispa											
04-176-2	M		1.089	4	3	1	4	W G2	wc	Best for crisp slough too great for ware	No w
04-176-3	M		1.083	2	2	2	4	W G2	wc	No scurf – best for crisp slough too great for ware	No w
04-176-4	VE		1.077	3	3	1	2	W G2	w	Nice skin	Yes w
04-176-7	ME		1.079	4	2	1	2	W G2	wc	Best for crisp – a bit flat For crisp SG needs to be ≥ 1.080	Yes w
04-176-8	ME		1.070	4	3	1	2	W G2	wc	Best for crisp For crisp SG needs to be ≥ 1.080	Yes w
04-176-15	E	WA	1.071	3	1	1	3	W G2	w	Nice shape - skin a bit russetted slough too great for ware	No w
Lustre x Ruby Lou											
04-178-1	ME		1.075	6	3	1	2	W G2	w	Pink – an improvement on Ruby Lou? – no fleck?	Yes w
04-178-2	ME		1.082	4	3	1	4	W G2	w	Pink slough too great for ware	No w
04-178-3	VL	WA	1.078	6	2	1	2	W G2	w	Cherry Red type skin – late maturity	Yes w
04-178-8	ML		1.077	5	2	2	3	W G2	w	Good colour – deep pink slough too great for ware	No w
04-178-13	M		1.079	4	3	1	1	W G2	w	Pink – too small	Yes w
Mondial x 85-30-12											
04-179-1	ML	WA	1.069	6	2	2	3	W G2	w	Lenticels and scurf slough too great for ware	No w
04-179-2	ML		1.081	6	3	2	2	W G2	w	Some distortions	Yes w

* Maturity, E = early, M = mid, L = late, V = very

† Fry colour: visually assessed on scale 1 - 10 (light to dark), <7 acceptable for crisp processing.

‡ Boiling tests: col = flesh colour

@ ACD (after-cooking-darkening): 1 = nil, 2 = slight, 3 = moderate, 4 = severe, 5=general blackening

~ Sloughing: 1 = nil, 2 = slight, 3 = moderate, 4 = severe, 5 = soupy.

~use: c = crisp, Ff = French fry, w = ware (fresh), g'met = gourmet, ? = questionable, + = very good

Table 5.6.2b continued. Ware selections for WA from selection plots harvested at DPIVAF-PBP in April 2006. Primary selection based on crosses (parents shown) and tuber characteristics. Final selection based on cooking quality.

Breeding line	Mat-* urity	Selected by	Spec. gravity	Fry† colour	Boiling tests‡ Col	ACD	Slough	Plots	WA use~	Comments	WA final selection
Selection criteria: →			≤1.065	<7		**≤2**	**≤2**				
Standard variety											
Coliban	L		1.071	5	2	1	3	W G2			
Desiree	ML		1.081	6	4	1	2	W G2			
Oceania x Wilwash											
04-181-1	E	WA	1.068	4	2	1	2	W G2	wc	Nice skin – some scurf For crisp SG needs to be ≥ 1.080	Yes w
04-181-2	ME	WA	1.064	6	3	1	2	W G2	w	Lenticels SG too low for ware	No w
04-181-5	ML	WA	1.073	4	3	2	2	W G2	w	Nice skin	Yes w
04-181-6	M		1.069	5	3	1	3	W G2	wc	Skin not that good but good shape For crisp SG needs to be ≥ 1.080, slough too great for ware	No c
04-181-12	M		1.077	5	3	1	4	W G2	Wc	Some lenticels, slough too great for ware	No c
Onka x Redsen											
04-182-3	ML		1.069	4	3	1	1	W G2	w	Very good crimson colour	Yes w
04-182-6	M	WA	1.082	4	3	3	2	W G2	w	Crimson – ugly but very good skin	Yes w
04-182-7	ME		1.071	6	2	2	3	W G2	w	Light pink colour no good – good shape and size, slough too great for ware	No w
04-182-8	ME		1.076	5	5	2	2	W G2	w	Crimson – skin blemish	Yes w
04-182-9	E	WA	1.071	3	2	1	2	W G2	w	Crimson	Yes w
04-182-10	M		1.076	5	3	2	1	W G2	w	Crimson -lenticels	Yes w
04-182-13	M		1.067	5	3	2	1	W G2	w	Crimson – shape not very good	Yes w
04-182-14	L		1.076	6	3	2	1	W G2	w	Pink - late maturity	Yes w
04-182-20	ME		1.069	3	3	2	1	W G2	wc	pink For crisp SG needs to be ≥ 1.080	Yes w

* Maturity, E = early, M = mid, L = late, V = very

† Fry colour: visually assessed on scale 1 - 10 (light to dark), <7 acceptable for crisp processing.

‡ Boiling tests: col = flesh colour

@ ACD (after-cooking-darkening): 1 = nil, 2 = slight, 3 = moderate, 4 = severe, 5=general blackening

~ Sloughing: 1 = nil, 2 = slight, 3 = moderate, 4 = severe, 5 = soupy.

~use: c = crisp, Ff = French fry, w = ware (fresh), g'met = gourmet, ? = questionable, + = very good

Table 5.6.2b continued. Ware selections for WA from selection plots harvested at DPIVAF-PBP in April 2006. Primary selection based on crosses (parents shown) and tuber characteristics. Final selection based on cooking quality.

Breeding line	Mat-* urity	Selected by	Spec. gravity	Fry† colour	Boiling tests‡ Col	ACD	Slough	Plots	WA use~	Comments	WA final selection
Selection criteria: →			≤1.065	<7		**≤2**	**≤2**				
Standard variety											
Coliban	L		1.071	5	2	1	3	W G2			
Desiree	ML		1.081	6	4	1	2	W G2			
Otway Red x Ida Rose											
04-183-1	ML		1.072	8	1	2	2	W G2	w	Crimson skin, fry too dark	No w
04-183-2	ML		1.072	8	3	2	2	W G2	w	Crimson – eyes too deep, skin too netted fry too dark	No w
04-183-3	ML		1.071	6	2	1	2	W G2	w	Crimson – a bit ugly	Yes w
04-183-4	ML		1.065	8	3	1	2	W G2	w	Wine red skin – heels too deep fry too dark	No w
04-183-5	ML		1.068	7	3	2	2	W G2	w	Crimson – scurf, skin a bit textured	Yes w
Otway Red x Ruby Lou											
04-184-2	L		1.075	5	1	3	3	W G2	w	Crimson, ACD slough too great for ware	No w
Pike x Sonic											
04-185-1	M		1.082	4	3	1	2	W G2	wc	Pink eyes – too small	Yes w
04-185-3	L		1.089	4	2	2	2	W G2	wc	Pink eyes – too ugly for ware	No w
Redsen x 80-98-7											
04-187-1	ME	WA	1.075	6	3	2	2	W G2	w	Very nice skin and shape	Yes w
04-187-9	M		1.079	5	3	3	2	W G2	w	Pink – good shape faded red skin ACD too great for ware	No w

* Maturity, E = early, M = mid, L = late, V = very

† Fry colour: visually assessed on scale 1 - 10 (light to dark), <7 acceptable for crisp processing.

‡ Boiling tests: col = flesh colour

@ ACD (after-cooking-darkening): 1 = nil, 2 = slight, 3 = moderate, 4 = severe, 5=general blackening

~ Sloughing: 1 = nil, 2 = slight, 3 = moderate, 4 = severe, 5 = soupy.

~use: c = crisp, Ff = French fry, w = ware (fresh), g'met = gourmet, ? = questionable, + = very good

Table 5.6.2b continued. Ware selections for WA from selection plots harvested at DPIVAF-PBP in April 2006. Primary selection based on crosses (parents shown) and tuber characteristics. Final selection based on cooking quality.

Breeding line	Mat-* urity	Selected by	Spec. gravity	Fry† colour	Boiling tests‡ Col	ACD	Slough	Plots	WA use~	Comments	WA final selection
Selection criteria: →			≤1.065	<7		**≤2**	**≤2**				
Standard variety											
Coliban	L		1.071	5	2	1	3	W G2			
Desiree	ML		1.081	6	4	1	2	W G2			
Ruby Lou x Fontenot											
04-189-10	M		1.080	5	2	2	2	W G2	w	crimson	Yes w
04-189-12	ML		1.086	7	3	2	2	W G2	w	Dark crimson skin ,late maturity , white lenticels , double skin	Yes w
04-189-14	ML		1.082	5	1	4	2	W G2	w	Crimson skin – a bit flat, ACD too great for ware	No w
Snogem x Onka											
04-193-1	E		1.082	4	3	1	1	W G2	w	Very nice skin - distorted	Yes w
04-193-5	ME	WA	1.081	4	3	1	2	W G2	w	Some pinched stems, really good skin, no blemish	Yes w
04-193-13	ME		1.080	6	2	2	3	W G2	w	Nice skin, shape not very good	No w
04-193-21	ML		1.077	7	2	1	2	W G2	w		Yes w
04-193-23	M		1.082	5	3	2	2	W G2	w		Yes w
Snowgem x 86-19-1											
04-194-1	ML		1.077	7	2	1	3	W G2	w	Very nice skin, distorted slough too great for ware	No w
Sonic x Crispa											
04-195-1	L		1.095	4	3	2	3	W G2	wc	Pink eye and blush slough too great for ware	No w
04-195-4	ML		1.088	4	3	2	2	W G2	wc		Yes w
04-195-9	VL		1.088	4	3	1	3	W G2	wc	Pink eyes and blush slough too great for ware	No w
04-195-10	ML		1.084	4	4	1	2	W G2	wc		Yes w

* Maturity, E = early, M = mid, L = late, V = very

† Fry colour: visually assessed on scale 1 - 10 (light to dark), <7 acceptable for crisp processing.

‡ Boiling tests: col = flesh colour

@ ACD (after-cooking-darkening): 1 = nil, 2 = slight, 3 = moderate, 4 = severe, 5=general blackening

~ Sloughing: 1 = nil, 2 = slight, 3 = moderate, 4 = severe, 5 = soupy.

~use: c = crisp, Ff = French fry, w = ware (fresh), g'met = gourmet, ? = questionable, + = very good

Table 5.6.2b continued. Ware selections for WA from selection plots harvested at DPIVAF-PBP in April 2006. Primary selection based on crosses (parents shown) and tuber characteristics. Final selection based on cooking quality.

Breeding line	Mat-* urity	Selected by	Spec. gravity	Fry† colour	Boiling tests‡ Col	ACD	Slough	Plots	WA use~	Comments	WA final selection
Selection criteria: →			≤1.065	<7		**≤2**	**≤2**				
Standard variety											
Coliban	L		1.071	5	2	1	3	W G2			
Desiree	ML		1.081	6	4	1	2	W G2			
Toolangi Delight x Red Ruby											
04-196-1	L		1.085	4	2	1	2	W G2	wc	purple	Yes w
04-196-2	L		1.084	4	1	1	3	W G2	wc	Purple, heels a bit deep slough too great for ware	No w
04-196-3	ML		1.075	6	2	2	1	W G2	w	Crimson, nice skin	Yes w
04-196-4	ML		1.086	5	2	1	3	W G2	w	Dark purple skin, best of this cross slough too great for ware	No w
Wilwash x Redsen											
04-197-1	E		1.071	5	2	1	4	W G2	w	Purple with purple blush in flesh slough too great for ware	No w
04-197-5	M		1.072	5	1	2	2	W G2	w	Purple, looks nice	Yes w
04-197-8	M		1.066	6	3	1	1	W G2	w	Pink, skin too pale, common scab	Yes w
66-11-2 x Wilwash											
04-198-1	ME		1.054	6	2	1	1	W G2	w	Too distorted, scurf SG too low for ware	No w
85-5-16 x Belchip											
04-200-7	ML		1.099	2	3	1	4	W G2	w/Ff	Space out for French fry slough too great for ware	No w
97-77-1 x Crystal											
04-203-6	E	WA	1.068	3	1	1	2	W G2	w	Shape a bit distorted	Yes w
04-203-8	ME		1.071	4	3	1	2	W G2	w	Scurf, distorted	Yes w

* Maturity, E = early, M = mid, L = late, V = very

† Fry colour: visually assessed on scale 1 - 10 (light to dark), <7 acceptable for crisp processing.

‡ Boiling tests: col = flesh colour

@ ACD (after-cooking-darkening): 1 = nil, 2 = slight, 3 = moderate, 4 = severe, 5=general blackening

~ Sloughing: 1 = nil, 2 = slight, 3 = moderate, 4 = severe, 5 = soupy.

~use: c = crisp, Ff = French fry, w = ware (fresh), g'met = gourmet, ? = questionable, + = very good

Table 5.6.2c. French fry selections for WA from selection plots harvested at DPIVAF-PBP in April 2006. Primary selection based on crosses (parents shown) and tuber characteristics. Final selection based on cooking quality.

Breeding line	Mat-* urity	Selected by	Spec. gravity	Fry† colour	Boiling tests‡ Col	ACD	Slough	Plots	WA use~	Comments	WA final selection
Selection criteria: →			≥1.089	≤7							
Standard variety											
R Burbank	ML		1.089	6	2	1	2	Mc G2	Ff	Standard variety	Yes
Eureka x 97-100-1											
04-20-10	ME	WA	1.084	5	3	3	2	Mc G2	Ff	Sg too low	No Ff
Wontscab x Trent											
04-25-8	M	WA	1.093	5	2	1	3	Mc G2	Ff		Yes Ff
88-59-12 x Ranger Russet											
04-28-6	M	WA	1.087	7	4	2	3	Mc G2	Ff	Sg too low	No Ff
97-100-1 x 96-141-12											
04-45-1	E	WA	1.096	5	3	1	2	Mc G2	Ff		Yes Ff
Wontscab x Crispa											
04-141-4	E	WA	1.073	3	3	1	2	Arn G2	w/Ff	SG too low for Ff	No Ff
Atlantic x Trent											
04-148-7	E	WA	1.086	3	3	2	3	Mc G2	Ff	Sg too low	No Ff
Clone 82 x 93-6-3											
04-154-19	L	WA	1.094	5	5	1	3	Mc G2	Ff		Yes Ff
Argos x Ruby Lou											
04-170-19	M		1.076	6	3	1	2	W G2	c/Ff	Mostly round, some oblongs For crisp SG needs to be ≥ 1.080	No Ff
04-170-26	ML		1.080	4	3	1	3	W G2	w/Ff	Pink – not much blemish For ware slough too great	No Ff
85-5-16 x Belchip											
04-200-7	ML		1.099	2	3	1	4	W G2	w/Ff	Space out for French fry slough too great for ware	Yes Ff

* Maturity, E = early, M = mid, L = late, V = very

† Fry colour: visually assessed on scale 1 - 10 (light to dark), <7 acceptable for crisp processing.

‡ Boiling tests: col = flesh colour

@ ACD (after-cooking-darkening): 1 = nil, 2 = slight, 3 = moderate, 4 = severe, 5=general blackening

~ Sloughing: 1 = nil, 2 = slight, 3 = moderate, 4 = severe, 5 = soupy.

~use: c = crisp, Ff = French fry, w = ware (fresh), g'met = gourmet, ? = questionable, + = very good

Table 5.6.2d. Other selections for WA from selection plots harvested at DPIVAF-PBP in April 2006. Primary selection based on crosses (parents shown) and tuber characteristics. Final selection based on cooking quality.

Breeding line	Mat-* urity	Selected by	Spec. gravity	Fry† colour	Boiling tests‡ Colour	ACD	Slough	Plots	WA use~	Comments	WA final selection
Selection criteria: →			≤1.065	<7		**≤2**	**≤2**				
Standard variety											
Atlantic	M		1.075	5	2	1	2	Arn G2	c		
Coliban	L		1.071	5	2	1	3	W G2			
Desiree	ML		1.081	6	4	1	2	W G2			
Otway Red x Ruby Lou											
04-184-1	ML		1.083	6	2	1	3	W G2	?	red?, slough too great	No
Toolangi Delight x Red Ruby								W G2			
04-196-5	ML		1.084	7	2	2	1		g'met	Crimson, very long and skinny, novelty, fry too dark	Yes
Wilwash x Redsen								W G2			
04-197-4	ML		1.061	5	3	1	1	W G2	?	Check skin colour, SG too low	No

* Maturity, E = early, M = mid, L = late, V = very

† Fry colour: visually assessed on scale 1 - 10 (light to dark), <7 acceptable for crisp processing.

‡ Boiling tests: col = flesh colour

@ ACD (after-cooking-darkening): 1 = nil, 2 = slight, 3 = moderate, 4 = severe, 5=general blackening

~ Sloughing: 1 = nil, 2 = slight, 3 = moderate, 4 = severe, 5 = soupy.

~use: c = crisp, Ff = French fry, w = ware (fresh), g'met = gourmet, ? = questionable, + = very good

6. Discussion

6.1. Introduction

This report gives results for just one year's activities, which is a short time for achieving outcomes from potato variety evaluation work. Nevertheless we have been aided by our previous variety evaluation projects which allowed us to harvest experiments which ranged from unreplicated screenings to demonstrations. We are also in the position to report on the results of commercial scale testing of some advanced breeding lines and the commercial release on one variety.

6.2. Quarantine

We have adopted a procedure whereby each tuber introduced from the DPIVAF-PBP breeding program can be tested for virus and also be retained for planting. AGWEST Plant Laboratories undertake this procedure. The procedure was successful and there was no sign of the suspected contamination of tubers with gibberellic acid which was thought to have caused multiple spindly shoots seen in the 2004/05 season (Dawson & Mortimore 2005). We are now confident that the virus testing procedure developed does not affect growth and so the first seed bulking in WA can be used as a screening for summer selection.

6.3 White Star (97-38-2)

The addition of White Star to the preferred variety list of the Potato Marketing Corporation of WA (2005) is an outcome with practical industry significance. By adding White Star to the preferred variety list the PMCWA show that they have confidence that the variety has merit and poses low risk to their marketing system. The addition of White Star to the preferred variety list also reduces the risk to seed growers that can occur if new varieties are not linked to a defined supply chain.

The benefits of White Star have been discussed before (Dawson & Mortimore 2004a, 2004b, 2005, Mortimore *et al.* 2005). They found that when planted in May at 30 cm White Star produced oblong tubers with shallow eyes and heel. Skin texture was smooth and skin and flesh colour was cream. Experimental results showed that White Star had outstanding performance in May plantings where its benefits over Delaware and Nadine were:

- better appearance than Delaware,
- better yield than Nadine,
- larger tubers than Delaware and Nadine,
- better fry quality than Delaware and Nadine,
- more tolerant to crocodile skin than Delaware,

White Star also had good tolerance to powdery scab.

Disadvantages compared with Nadine from May plantings were that White Star's resistance to PCN is not known. However there is a high chance that White Star may have resistance to PCN because its parents are Gladiator x 91-158-6. 91-158-6's parents were 86-12-17 and Atlantic. Gladiator and Atlantic are PCN resistant (either *Globodera pallida* and/or *G. rostochiensis*) so there is a better than 50% chance that White Star is also resistant to PCN. White Star's resistance to PCN is currently being

assessed by DPIVAF-PBP (Tony Slater, personal communication). A summary of experimental results from Dawson & Mortimore (2004a) is given in Table 6.3.1.

Table 6.3.1. Summary of May experimental WA plantings White Star (97-38-2). From Dawson & Mortimore (2004a) and Table 5.3.2.1.

Entry & tuber* characteristics	Spac-ing in rows (cm)	Yield (t/ha) Small 70-120g	Medi-um 120-350g	Large 350-450g	Grade No. 1 70-450g	Over-size >450g	Tuber no. per plant	Tuber av mkt wt (g)	Quality SG	Fry# color (Crisp)	ACD	Sloug-hing	Flesh faults (%)†	Bloom after 14 d
Averages across May planted experiments (winter screening excepted)														
May plantings, n = 3									(n=2)					(n=1)
Delaware		13.5	45.9	0.9	60.3	0.2	10.3	141	1.067	5.8	1.4	1.9	1.0	0
Nadine		13.6	32.7	1.1	47.3	0.2	9.6	128	1.054	9.0	1.0	1.7	0.0	76
97-38-2 (W'Star)		4.3	49.4	1.3	55.0	0.1	8.0	174	1.068	4.4	1.30	1.7	0.0	32
Individual experiments														
Trial 00PE1.	May planted unreplicated winter screening at Baldivis 2000. 97-38-2 was selected.													
Delaware	24				40.0				1.067	8	2	2	0	-
Nadine	24				46.0				1.051	10	1	1	0	-
95-38-2 (W'Star)	24				50.0				1.065	5	1	1	0	-
Trial 01PE8.	May planted ware district trial at Mandogalup 2001. 97-38-2 was selected.													
Delaware	24	12.3	41.6	0.8	54.7	0.3	8.2	164	1.065	6.3	1.2	1.8	3	-
Nadine	24	19.3	30.6	0.0	49.9	0.0	10.9	127	1.054	9.0	1.0	1.2	0	-
97-38-2 (W'Star)	30	5.2	51.0	0.6	56.9	0.3	8.6	167	1.071	4.3	1.0	1.0	0	-
LSD 5%		3.3	6.5	skew	5.5	skew	1.2	14	0.003	1.2	skew	skew		
Trial 02AL39PE.	May planted demonstration at Mandogalup, 2002.								Cooking tests‡ SG	taste	mash	micro	fry	
Delaware	25	12.1	42.4	1.8	56.3	0.3	8.8	137	1.071	**	**	**	*	0
Nadine	25	9.4	20.1	1.6	31.1	0.7	7.4	120	1.054	nr	**	**	nr	0
97-38-2 (W'Star)	30	4.9	41.2	1.2	47.3	0.0	7.3	165	1.068	**	***	***	**	4
Trial 2005.	May planted demonstration at Mandogalup, 2005.								Cooking tests‡ SG	taste	mash	micro	fry	
Delaware	25	5.4	16.1	53.7	0.0	69.8	0.0	123	1.064	**	**	**	*	0
Nadine	25	3.2	12.0	47.3	1.7	61.0	0.0	137	1.053	nr	*	***	nr	0
97-38-2 (W'Star)	30	1.2	2.8	56.0	2.0	60.8	0.0	191	1.065	**	***	**	***	0

Disease screenings

Trials 01PE10 & 02AL40. Autumn planted disease screenings at Baldivis, 2001 & 2002.

	Powdery scab 01PE10 SI~	01PE10 Rating	02AL40! SI~	02AL40! Rating	overall rating	Crocodile skin 01PE10 SI~	01PE10 Rating	02AL40 SI~	02AL40 Rating	overall rating
Desiree	1.87	tol	0.44	tol	tol	0.38	h sus	1.07	h sus	h sus
Nadine	2.26	tol	0.80	tol	tol	0.01	tol	0.08	tol	tol
97-38-2 (W'Star)	2.01	tol	1.58	tol	tol	0.01	tol	0.13	tol	tol
LSD 5%	0.41		1.32			0.27		0.18		
LSD 1%	0.54		1.74			0.36		0.23		

*Tuber characteristics; **bold** type = good, plain type = questionable, *italic* = poor.
Samples assessed visually: If crisp indicated then scale 1 - 10, 7 = borderline for French-fries, >7 = too dark.
† Flesh faults; † indicates significantly different internal disorders from Delaware.
‡ Cooking tests: nr = not recommended, * = fair, ** = good, *** = excellent
~ SI = Severity index = ((no. tubers 0-5% surface affected)+(tubers 5-25% x 2) + (tubers >25% x 3))/total no. tubers
If ns greater from control (Desiree for scab & Nadine for croc skin) then entry is classed as "tolerant"
If sig greater (P=0.05) than control the entry is classed as "susceptible"
If highly sig diff (P=0.01) from control then entry is classed as "highly susceptible."
! For these trials severity index is an arcsin transformation

The Benefit Cost Analysis presented in Section 5.2.3 quantifies some of these benefits. The gross margin shown in Table 5.2.3.1 shows White Star provides an increased gross margin of $10,569/ha compared with Nadine's $6,739/ha. The increased gross margin is due to improved yield and price and reduced seed costs. This BCA is summarized in Table 6.3.2 which shows a NPV of $3.4 million with a benefit cost ration of 12.6.

Table 6.3.2 Summary of benefit cost analysis on total funds for potato variety evaluation in WA. From Mattingley (2006).

Net Present Value ($m)	Benefit Cost Ratio	Project costs over 4 years	Probability of success
$3.4 M	12.6	$297,502	85%

Whilst WA has a relatively small domestic market for potatoes the economic assessment demonstrates the benefits of introducing new fresh market varieties to increase the supply to the market, expand the market, and provide import substitution during the winter period. This is an example of the benefit that the public variety evaluation program can industry through responding more directly to fresh market needs. When this occurs Peterson and Batterham (2003) report a significant potential payoff can occur and so provide justification for the continuation of the breeding initiative.

White Star was bred in Australia at the National Potato Improvement Centre in Victoria by Dr Roger Kirkham. Its parents were Gladiator and the breeding line 91-158-6.

6.4 Auski & Billabong commercial tests

The 2005 planted commercial strips of Auski demonstrated to industry representatives satisfaction that its reaction to silver scurf (*Helminthosporium solani*) and black dot (*Colletotrichum coccodes*) was a major fault indicating the variety did not have a commercial future.

Billabong exhibited a greater tolerance to these blemish diseases even though it matured four weeks prior to Auski which would have given the blemish pathogens silver scurf (*Helminthosporium solani*) and black dot (*Colletotrichum coccodes*) greater opportunity to affect this variety. Billabong's field tolerance to the blemish disease warrants this variety being tested further. When this testing is undertaken measurements of ACD of Billabong and adjacent commercial varieties should be tested to determine whether the egree of ACD shown by Billabong is acceptable.

Billabong (95-37-12) was bred by the DPIVAF-PBP by Dr Roger Kirkham. Its parents were Mondial x 85-30-12. Experimental results from October/November plantings from Dawson & Mortimore (2004a) show that Billabong has:

- better appearance than Delaware,
- higher specific gravity than Delaware and Nadine,
- better fry quality than Delaware and Nadine,
- better taste than Nadine,
- better post harvest skin bloom than Delaware and Nadine, but
- light yellow flesh and

- darker after-cooking-darkening than Nadine and Delaware.

6.5 Demonstrations

6.5.1 Bliss (90-2-6)

Demonstration tests of Bliss (90-2-6) at Lancelin, north of Perth, have resulted in the grower commencing commercial testing of this variety. Although the demonstration tests were affected by poor crop growth, the high yielding September planted demonstration showed that Bliss produced 117% of the yield of the better Atlantic plot with specific gravity of 1.087 compared to Atlantic's average of 1.085. Bliss also performed better than Atlantic in the March/April planted commercial strip with 23 t/ha greater yield, specific gravity of 1.085 compared to Atlantic 1.076 with no flesh defects compared to the 20% found in Atlantic.

Bliss is a new crisp variety, being adopted by crisp growers at Manjimup and Pemberton where it offers better quality and yield than Atlantic (Dawson & Mortimore 2004a) in summer planted crops. At Lancelin which is a winter production site the benefits of higher yield and higher specific gravity compared with Atlantic should offer similar, if not greater benefits, to those found by growers at Manjimup and Pemberton.

6.5.2 Forester (99-23-11)

Forester was tested in three demonstrations and one commercial strip at Lancelin alongside Bliss and Atlantic. Results indicate that, although Forester has fewer flesh defects than Atlantic, it does not offer Bliss' additional benefits of improved yield and specific gravity. In the September planted demonstration (Section 5.3.3.2) Forester had lower specific gravity and yield than Atlantic but reduced defects (Tables 5.3.3.2a & b). In the November planted demonstration Forester had higher specific gravity and fewer defects than Atlantic but Bliss performed better than Forester (Table 5.3.3.3). In the commercial strips Forester again had lower yield than Atlantic though specific gravity was similar while no defect were found compared to the 20% shown by Atlantic. Further commercial testing of Forester is proceeding at Lancelin.

6.5.3 Cherry Red

The November planted demonstration of fresh varieties at Pemberton (Section 5.3.22) showed this variety may offer a darker coloured red skinned potato than Ruby Lou for summer cropping. Its yield was similar to Ruby Lou and it had less internal disorders. Its susceptibility to powdery scab (Dawson & Mortimore 2005) means that it would be risky to grow this variety in winter. Commercial testing will commence in the 2006/07 season.

Cherry Red was bred from the cross (ND4750-2R x LA1858) and released by the Colorado, North Dakota and Texas Agricultural Experiment Stations in 1999 for the fresh market in North America (Graeme Wilson, personal communication).

6.5.4 Michaela (98-4-5)

Michaela (98-4-5) did not produce low scores for ACD at Pemberton as expected although it produced consistently high yields (Table 5.3.2b). Tuber shape was a little rough and this variety does not warrant further commercial testing next season. To

confirm whether testing of Michaela should cease it should be tested in this coming season's district trial at Manjimup to give it another chance.

6.6 Suggestions for future crosses for WA breeding lines

The fault responsible for most rejections from the "03" series of fresh market breeding lines at the unreplicated screening stage (Section 5.5.3), apart from tuber characteristics, was ACD. ACD accounted for 25% of rejections. The screening the lines were subjected to was based on cooking data supplied by DPIVAF from cooking tests done at the selection plots harvest in 2005 at Toolangi. Screening characteristics used were SG, ACD and slough. Table 5.5.3.b shows that for 28 varieties and breeding lines where ACD test data was available from DPIVAF (2005) and DAFWA (2006) 25 had more severe, or darker, ACD at Margaret River than at DPIVAF Toolangi. It appears that conditions at Margaret River are more conducive to this disorder than those at Toolangi. This means that breeding lines should be screened harder for this disorder. The high number of rejections for ACD indicates that this quality is more severe at Margaret River in WA than at Toolangi. The WA potato industry would benefit from the breeding program undertaking crosses which produce progeny with low levels of ACD.

Crisp

With crisp market types we found that low specific gravity accounted for 23 out of 32, or 72% of rejections from the unreplicated screening stage. As above, entries were screened before planting with emphasis based on SG and fry colour (Dawson & Mortimore 2005) using cooking data from the DPIVAF selection plots harvest of 2005. 18 crisp breeding lines selected for testing in WA where SG data was available from DPIVAF (2005) and DAFWA (2006,) most 15 had lower SG at Margaret River than at DPIVAF Toolangi. SG was converted to dry matter and a comparison made which showed that on average the WA test was only 90% of the dry matter test result done in Victoria. The high number of rejections for low specific gravity may indicates that the WA potato industry requires breeding lines with higher specific gravity than is acceptable in the eastern states. This shows that strict selection using SG cooking data from DPIVAF is sound and even stricter selection criteria might be usefully applied.

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6.7 Outcomes achieved compared with objectives

Our objective to provide the WA industry with an improved variety for winter production has been achieved with the addition of White Star to the preferred variety list of the Potato Marketing Corporation of WA. A benefit cost analysis of the evaluation work undertaken for the development of White Star shows a net present value of $3.4 M with a benefit cost ratio of 12.6 (Mattingley 2006).

We also aim to develop improved crisp varieties for the export trade in fresh potatoes for crisp processing in SE Asia. The demonstration of Bliss' performance indicates that WA may be able to increase exports through extending the supply season of high quality affordable potatoes which meet processors demands.

7 Technology Transfer

The major technology transfer activities were:

1. The fourth year commercial testing of White Star for winter production for the fresh market was completed. The result was that White Star was added this variety to the preferred variety list of the Potato Marketing Corporation.
2. The second year of commercial testing of Auski and Billabong for summer production for the fresh market. This was held in conjunction with a "field day" at a wash-packers.
3. Commercial testing commenced for the red skinned winter variety Flame.
4. Commercial testing commenced for the white skinned summer variety Michaela.
5. Three crisp demonstrations planted on a major crisp producer's crop at Lancelin of Bliss and Forester. These were followed by the first commercial scale strips.
6. A demonstration was planted to evaluate the performance of the summer red skinned variety Cherry Red.
7. The project advisory committee met to determine industry priorities. New priorities for the development of a summer grown variety to complement Nadine were set.
8. Potatoes Australia Review 2006 article describing the emerging varieties; White Star, Bliss, Billabong.
9. Report to the Potato Producers Committee of the APC in February 2006.

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Figure 7.1. Growers and industry representatives participating in selection of breeding lines at the harvest of a demonstration of fresh market varieties grown by the Grubelich family. October 2005, Baldivis, near Perth.

8. Recommendations

Potato variety evaluation for the fresh market in WA was shown to be a good investment for the potato industry. Therefore the work should continue with a new focus. The priority now should be to develop improved varieties suited to summer production that have the following characteristics:

- resistance to blemish diseases,
- low after cooking darkening,
- attractive appearance, and
- versatile cooking quality with good taste.

In future crosses should be planned with the breeder that will provide breeding lines with the characteristics required by the WA potato industry. The advisory committee to the project should be consulted by FNECC before they discuss crosses with the DPIVAF-PBP.

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Abbreviations & definitions

ACD	after-cooking-darkening
BCR	benefit cost ratio
c	crisp
DAFWA	Department of Agriculture and Food, Western Australia formerly DAWA Department of Agriculture, Western Australia formerly AGWA Agriculture Western Australia
DPIVAF	Department of Primary Industries, Victoria, Agriculture and Food
DPIVAF-PBP	Department of Primary Industries, Victoria, Agriculture and Food Potato Breeding Program
ELISA	enzyme linked immunosorbent assay
Ff	French fry
FNECC	National Evaluation & Commercialisation Committee for the Fresh Potato Breeding Program
FOB	free on board
G	generation
g	gram
ha	hectare
HAL	Horticulture Australia Limited
HRDC	Horticultural Research and Development Corporation (now HAL)
NaPIES	National Potato Improvement Scheme
NPV	net present value
nr	not recommended
PCN	potato cyst nematode
PGA	Potato Growers Association
PLRV	potato leafroll virus
PMCWA	Potato Marketing Corporation of Western Australia
PVS	potato virus S
PVX	potato virus X
PVY	potato virus Y
SG	specific gravity
t	tonnes
t/ha	tonnes per hectare
TSWV	tomato spotted wilt virus
w	ware
WA	Western Australia
ware	Means the same as "fresh". Often used in young generation selections trials as its abbreviation w cannot be confused with Ff used for French fry.