

**Variety development for the  
fresh potato market in WA  
2006/08**

Peter Dawson  
Department of Agriculture & Food  
Western Australia

Project Number: PT06003

## **PT06003**

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**FINAL REPORT**

**HORTICULTURE AUSTRALIA LIMITED**

**PROJECT PT06003**

**VARIETY DEVELOPMENT FOR THE FRESH POTATO MARKET  
IN WESTERN AUSTRALIA 2006-08**

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

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## **Media Summary**

### ***Key components of project***

We aim to increase consumer satisfaction and productivity of the WA potato industry through the development of improved fresh market varieties. Many new varieties are obtained from the Australian Potato Breeding Program run by the Department of Primary Industries, Victoria. These are grown over four seasons under WA conditions until the one that best meets the requirements of producers, merchants and consumers is identified.

### ***Industry significance***

In Western Australia the potato industry believes that consumer expectations will be better fulfilled if a summer grown variety to complement Nadine can be found. Challenges are to select a variety with both the visual characteristics of Nadine and the culinary attributes of Royal Blue. Versatile cooking quality is important, no discolouration should occur during cooking and taste must be rated as good as Royal Blue or White Star.

### ***Key outcomes***

The new variety White Star was launched at the Perth Royal Show in October 2007. White Star is suited winter production and solves problems that previously confronted the WA potato industry. White Star's benefits are better appearance than Delaware, better yield than Nadine, larger tubers than Delaware and Nadine, better fry quality than Delaware and Nadine plus White Star also had good disease tolerance.

Consumers also benefit from White Star. An independent culinary evaluation commissioned by Western Potatoes Limited showed that White Star had similar taste, texture and flesh colour to Royal Blue (Ray Wilson, personal communication). This is a highly propitious finding as Royal Blue is considered to be the best tasting potato available in Western Australia. Samples of White Star were given to chefs who commented how they loved White Star and could easily use them in restaurants (Ray Wilson, personal communication). This means that WA consumers now have the benefit of a mainstream variety with the culinary quality of Royal Blue.

### ***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***

Parents which have previously been found to be associated with traits important for the WA potato industry were identified. These should be considered for future crosses to benefit the potato industry of WA.

### ***Recommendations for practical application to industry***

- The advanced pink skinned fresh market breeding line Flame should be commercialised.
- The French fry breeding line 97-107-13 merits further testing.

## **Technical Summary**

### ***Nature of problem***

Current varieties do not always meet potato purchasers' specifications. This means the industry does not operate to its full potential. Therefore variety improvement has been a national priority of the fresh potato industry. The WA potato industry believes that consumer expectations will be better fulfilled if a summer grown variety to complement Nadine can be found. Challenges are to select a variety with both the visual characteristics of Nadine and the culinary attributes of Royal Blue. Versatile cooking quality is important with no after-cooking-darkening. Taste must be rated as good as Royal Blue and White Star. The variety must be tolerant of the hot summer conditions in Manjimup/Pemberton; no heat sprouts should be produced. Resistance to blemish diseases (silver scurf and black dot) is required. Yield must be equivalent to Ruby Lou.

### ***Research undertaken***

In order of the oldest to the youngest breeding lines, outcomes were:

- White Star was launched at the Perth Royal Show in October 2007.
- Flame (98-34-11) was recommended for commercialisation.
- The French fry breeding line 97-107-13 was found to merit further testing.
- "01" and "02" breeding lines were tested in a replicated district trial in 2006-07 and then in a demonstration in 2007-08. None were selected for further testing
- The "03" series of breeding lines were tested in a replicated screening in 2006-07 and then in a replicated district trial in 2007-08. None were selected for the subsequent demonstration testing phase.
- The "04" breeding lines were tested in both an unreplicated screening in 2006-07 and then a replicated screening in the following season. The outcome is that five were selected for testing in a future district trial.
- Twenty-two fresh market breeding lines from the "05" series were tested in an unreplicated screening in 2007-08 and 20 were selected for further testing

### ***Major findings & industry outcomes***

The new variety White Star was launched at the Perth Royal Show in October 2007. White Star is suited winter production and solves problems that previously confronted the WA potato industry. White Star's benefits are better appearance than Delaware, better yield than Nadine, larger tubers than Delaware and Nadine, better taste and fry quality than Delaware and Nadine plus White Star also had good disease tolerance.

### ***Recommendations***

Under new arrangements of the National Potato Breeding Program new exclusive breeding material will be bred for WA. The availability of breeding lines will be reduced, so to compensate this, material should be tested in WA at the seedling stage. This will mean all selection will be under WA conditions the program will have a greater chance of success.

### ***Future work***

This program has a history of success and is a worthwhile investment for the industry. The program should continue.



### **3. Introduction**

#### **3.1 Historical Background**

This project (PT06003) continues work began in 1989 with HRDC Project PT017 *Potato Variety Evaluation for local, export and processing markets* (Dawson *et al.* 1997). This original project commenced to help the industry meet the challenges faced with developing processing industries, exotic pest threats like potato cyst nematode as well as consumer and supermarket demands for more appealing fresh market products. 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 and Evaluation Scheme (NaPIES) that commenced in 1993. This scheme was based on the Department of Primary Industries, Victoria Potato Breeding Program (DPIV-PBP) with evaluation of breeding lines being carried out in all states. The last four 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), PT04023 *Variety development for the fresh potato market in Western Australia* (Dawson & Mortimore 2005) and (PT05017) *Variety development for the fresh potato market in Western Australia 2005-06* (Dawson & Mortimore 2006).

These projects have identified several varieties that now make up the bulk of potato production in WA. These are Nadine, Mondial, Ruby Lou and White Star for the fresh market plus Dawmor and Bliss for crisp processing and export and Eureka (Riverina Russet) for the local French fry industry.

#### **3.2 Significance to Industry**

Current varieties do not always meet potato purchasers' specifications. This means the industry does not operate to its full potential. Therefore variety improvement has been a national priority of the fresh potato industry and there have been several bodies charged with coordinating potato variety evaluation to ensure this work is carried out efficiently and uniformly. The National Potatoes Improvement and Evaluation Scheme (NaPIES) was followed by The National Evaluation and Commercialisation Committee for the Fresh Potato Breeding Program (FNECC 2004). Now individual investors representing grower groups or commercial entities invest directly in the National Potato Breeding Program to secure exclusive breeding lines for development.

In Western Australia the potato industry believes that consumer expectations will be better fulfilled if a summer grown variety to complement Nadine can be found. Further details of the industry's requirements can be found in Section 4.4 "Selection Criteria".

#### **Aim**

The project was undertaken to provide superior potato varieties better suited to the requirements of the WA potato industry. In particular we are looking for improvement in summer grown varieties for the fresh market. Improved varieties will have white skin with good appearance and versatile cooking quality with no after-cooking-darkening (ACD).

## **4. Materials and Methods**

### **4.1 Sources of genetic material**

#### ***Breeding***

New varieties were bred by the Department of Primary Industries Victoria Potato Breeding Program (DPIV-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 "Selection Plots" and tuber characteristics and cooking tests are used to select material for further testing.

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.

#### ***New material tested in this project***

In 2006 about 45 crisp breeding lines were selected from the Selection Plots for Western Australia (WA). 58 fresh market breeding lines were also selected for testing in WA. In 2007 about 25 breeding lines were available and these were selected from 138 crisp and 383 fresh market Selection Plots.

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.

### **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 as per National Registration Authority off-label permit PER5244) upon arrival in WA. This treatment can burn tuber sprouts 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 (PVY)(Holland and Jones, 2005). The newly introduced 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 are 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 DPIV-PBP.**

Tubers from DPIV-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 unreplicated screening which also produces seed for subsequent tests.

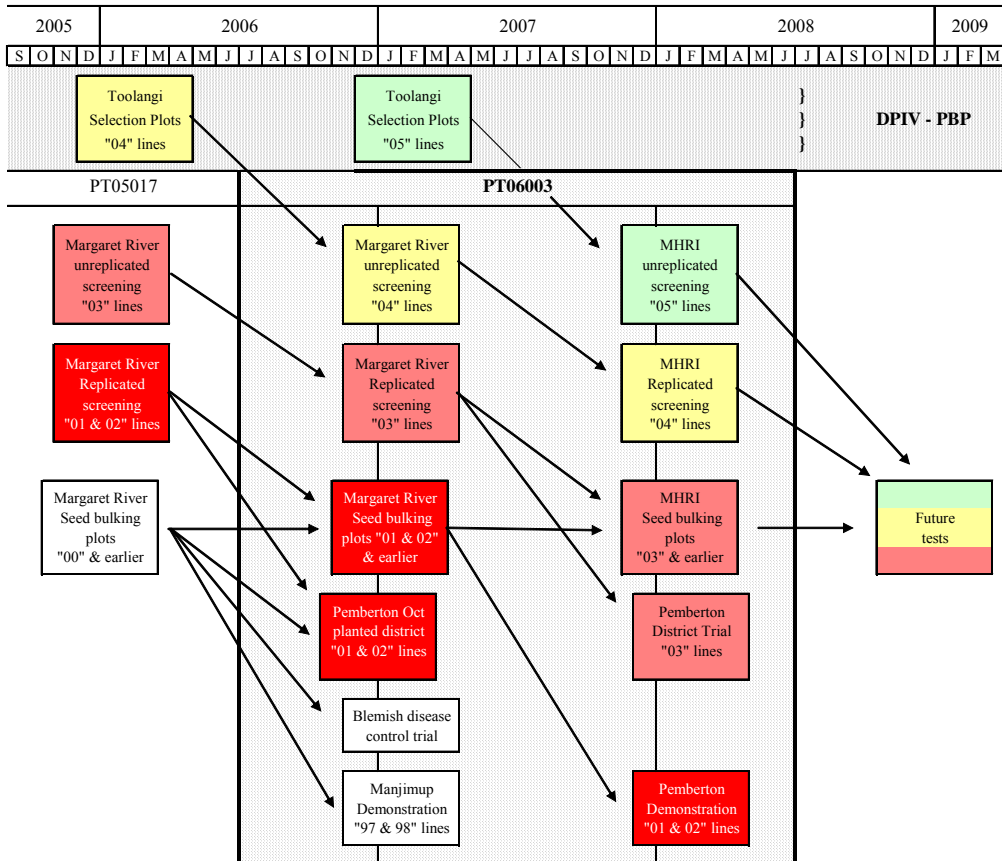
The next phase of testing is a replicated screening. This is planted in the summer production areas of Margaret River or Manjimup. Selections from this screening proceed to a replicated district variety trial.

Concurrent with the replicated district variety trial is a seed bulking plot which maintains the breeding lines within the WA Certified seed scheme.

The next phase of testing is a demonstration which is planted in the major summer production area of Manjimup/Pemberton. The demonstration phase is unreplicated but has larger plots. Farmers and other industry representatives are invited to participate in the selection of varieties at the harvest of the demonstration.

Concurrent with the demonstration is another seed bulking plot which maintains the breeding lines within the WA Certified seed scheme.

Figure 4.3 gives a flow diagram of the tests undertaken in this project.



**Figure 4.3. Flow diagram showing potato variety evaluation activities undertaken in this project. Also shown are the sources of seed from the previous project (PT05017) and from the Department of Primary Industries Potato Breeding Program.**

### *Type, design and 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 Selection Plot material grown at the DPIV-PBP potato breeding station. A member of the Department of Agriculture and Food, WA (DAFWA) potato evaluation team attends harvest at the DPIV-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 about 25 selections are supplied by the DPIV-PBP. Tubers of standard varieties are also obtained from the DPIV-PBP to ensure seed of the standard varieties is of the same generation and physiological age as the breeding lines.

#### **Unreplicated Screening (G2 planted)**

The first seed bulking is planted in October/November. In 2006-07 these were planted in the high yielding seed production area of Margaret River. In 2007-08 they were planted at the Manjimup Horticultural Research Institute. Two of the three tubers are used to plant two-row plots, each with eight plants at 25 cm spacing between sets. 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. This plot also provides seed for all subsequent activities.

#### **Replicated screening (G3 planted)**

Selections from the unreplicated screening are grown in a replicated screening at Margaret River/MHRI late in the following October. This screening doubles as the second seed bulking. 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 randomised block design. A twin row digger is used at harvest. Sufficient seed is produced to plant a district trial and a seed plot for further bulking. Seed for these activities is cool-stored from May until October.

#### **District Trial (G4 planted)**

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 a dozen entries have been tested in recent years but this number is expected to increase once more breeding program material becomes available.

#### **First seed bulking (G4 planted)**

Selections from the district trial are grown in a dedicated seed bulking planted at Margaret River/MHRI late in the following October/November. Two row plots, each 5 metres long are used to produce about 30 kg of seed.

### **Demonstration (G5 planted)**

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, two-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 for everyone 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.

#### **4.4 Selection criteria**

In 2007 a new committee was formed to guide the evaluation of new varieties in WA. The committee is called the Variety development Group and is made up of Industry stakeholders from the Potato Growers Association, from The Potato Marketing Corporation of Western Australia, from Western Potatoes Ltd and from DAFWA.

The priority is for a new white skinned variety for summer production to complement Nadine. Challenges are to select a variety with both the visual characteristics of Nadine and the culinary attributes of Royal Blue. Versatile cooking quality is important and no after-cooking-darkening is essential. Taste must be rated as good as Royal Blue and White Star. The variety must be tolerant of the hot summer conditions in Manjimup/Pemberton with no heat sprouts produced. Resistance to blemish diseases (silver scurf and black dot) is required. Yield must be equivalent to Ruby Lou.

From breeding lines already on-hand, crisps lines will be selected that show improvements in yield and quality over Atlantic and Bliss. Main quality factors are shape, eye depth, specific gravity, fry colour and internal disorders.

#### **4.5 Measurements**

##### ***Growth characteristics***

Emergence, closure and maturity are recorded as the time for 50% of plants to respectively emerge, close-in-the-rows or senesce. The tick sheet shown in the Appendix is used to record this data. Dormancy is assessed by noting when 3 out of 5 tubers, stored under sacks in a shed, had shoots 3 mm long.

### ***Tuber characteristics***

At harvest the tick sheet is also used to assess tuber characteristics. 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. An example of the tick sheet is given in the Appendix.

### ***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 that maintain their appearance in the market chain.

### ***Grading for yield***

The grades used vary with market type and are shown in Table 4.5.1. Where varieties for several markets are tested in the one trial fresh grading standards are used.

**Table 4.5.1. 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 replicated screening and the district trial 10 tubers from each plot are 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***

The crisp frying 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 4.5.2. Oil is changed after 90 frying tests.

#### ***Domestic French-fries***

Fresh French-fries for domestic use are cooked for assessment by Western Potatoes Ltd (WPL) 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**

Three 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 4.5.3.

### **Demonstration tests**

For the fresh market, WPL assesses samples which are cooked at the DAFWA potato laboratory at Bunbury. Tests are as above but a microwave and taste tests are added.

#### ***Microwave and taste test***

Two tubers of about 200 g are tested individually. The tubers are washed, dried and their skins pricked. One tuber is placed in a WPL 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 micro waved 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. Score 1 is "not recommended", score 2 is fair, score 3 is



good and score 4 is excellent. The flaking of the flesh also releases aroma which can be assessed.

Taste is assessed as per Slater *et al.* (2005).

**Table 4.5.2. 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
Desired colour	3	Light yellow	↑ Acceptable after 3'45'' frying for frozen product	3 (0)	Light yellow
	4	Yellow		4 (1)	Yellow
↓	5	Light gold	↓ Acceptable after 5' + 3' frying for fresh product	5 (2)	Light gold
	6	Gold		6 (3)	Gold
Borderline for crisps	7	Dark gold	↑ too dark ↓	7 (4)	Dark gold
Borderline for French fries	8	Brown			
↑	9	Dark brown	* American French fry colour chart score shown in brackets		
Too dark	10	Black			
↓					

**Table 4.5.3. 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.

## **5. Results**

### **5.1 Background**

The most recently obtained breeding lines from the National Potato Breeding Program run by the Department of Primary Industries, Victoria were from the "05" series. Twenty-two fresh market breeding lines were tested in an unreplicated screening in 2007-08 along with two crisp breeding lines.

The "04" breeding lines were tested in both an unreplicated screening in 2006-07 and then a replicated screening in the following season.

"03" series of breeding lines were tested in a replicated screening in 2006-07 and then in a replicated district trial in 2007-08.

"01" and "02" breeding lines were tested in a replicated district trial in 2006-07 and then in a demonstration in 2007-08.

French fry selections of the "97" and "98" series of breeding lines were also tested in a demonstration in 2006-08.

The remaining tests were of advanced material are described in the next sections and subsequent sections show the results in order of breeding line series from oldest to newest acquisitions.

## **5.2 “98” and 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). Two potential French fry breeding lines were tested in a demonstration; Monaro (97-102-1) and (98-107-13). Flame (98-34-11) is a selection from this series that is now in early commercial scale tests. Two breeding lines from earlier series are also undergoing commercial evaluation. These are Billabong (95-37-12) and White Star (97-38-2). Results of these tests will be discussed below in reverse order.

### **5.2.2 White Star Launch 2007**

White Star was launched at the Perth Royal Show in September 2007 by the Honourable Mr Kim Chance, Minister for Agriculture and Food in Western Australia (Australian Labor Party 2007). The launch occurred after during the fifth year of commercial testing as this was the first time sufficient retail quantities were available to ensure any member of the public could purchase the variety following interest generated by the publicity of its launch.

In preparation for the launch a Farmnote was printed (Mortimore & Dawson 2007) and Western Potatoes Ltd (WPL) commissioned a further independent culinary evaluation. The culinary evaluation was highly complimentary to White Star potato and showed that White Star had similar taste, texture and flesh colour to Royal Blue (Ray Wilson, personal communication) and that White Star was a superior variety of potato in both culinary versatility and flavour compared to the Nadine which dominates the Western Australian market.

The launch was reported in the mass media through television, radio and the internet as well as in the daily newspaper, for example see Perry (2007). Further details can be found under Technology Transfer (Section 7).

### **5.2.3. Commercial tests of Billabong (95-37-12)**

Billabong (95-37-12) was a breeding line identified by Dawson & Mortimore (2006) as potential candidate for summer production and it has undergone several years of commercial testing. Billabong was found to have superior appearance and tolerance to blemish diseases. However there was concern with its ACD. Billabong’s ACD varied from site to site with a range of scores from 1.5 to 3.5 from 2006 harvested plots. Previous ACD tests from October/November plantings of Billabong averaged score 3.0 (Dawson & Mortimore 2004a). ACD scores above 2 are a concern and so further assessment needed to be done to determine whether Billabong is suitable for commercial production.

In April 2007 cooking tests commissioned by WPL showed that ACD was worse than other varieties and that mashing quality was poor. These characteristics meant the variety would not be suitable for commercial production and testing of the variety ceased.

#### **5.2.4. Flame (98-34-11)**

The pink 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 then selected for further tests from a winter demonstration planted in 2005 (Dawson & Mortimore 2006).

A larger test of Flame (98-34-11) was planted in a strip in a commercial crop in 2006 and this was harvested November. Results of yield were very promising and this variety is being considered for commercialisation.

#### **5.2.5. November planted French fry demonstration of “97” and “98” series of breeding lines 2006-07**

##### **Aim and background**

To demonstrate the performance of two potential French fry breeding lines for summer production in the Manjimup/Pemberton region. Entries were Monaro (97-102-1) and 98-107-13 which had been selected from district trial or replicated screening tests that were carried out from 2000 to 2002 under project PT00010 (Dawson & Mortimore 2004a). Since these tests the summer testing program was disrupted with the finding of PVY (Dawson & Mortimore 2004b) and then a switch in priorities which led to selection of breeding lines for winter production in the Perth metropolitan area (Dawson & Mortimore 2005). Now the program priorities have again changes and again work is taking place at Manjimup/Pemberton which allows the completion of testing of these "97" and "98" breeding lines.

##### **Results**

The demonstration was planted in late November and grew well with no disease or insect damage. The standard variety, Ranger Russet produced 48.9 t/ha of Fry Grade tubers (>100 g) while Monaro (97-102-1) produced 42.4 t/ha and 98-107-13 produced 53.6 t/ha (Table 5.2.5). MacRusset was also tested and produced 37.4 t/ha. Specific gravity of Ranger Russet was 1.078 while 98-107-13 had the highest specific gravity of 1.083. Both Monaro (97-102-1) and MacRusset had specific gravity of 1.079. Fry colour Ranger Russet was 4 while the other entries all cooked to a darker, but acceptable score of 5 (Table 5.2.5).

The high yield and specific gravity of 98-107-13 shows that further testing is warranted to confirm whether 98-107-13 has benefits for commercial production.

**Table 5.2.5. Yield and quality of French fry entries in a November 2006 planted demonstration at Manjimup. Grower A Parker, Pemberton, WA**

Planted 22 November 2006 Harvested 3 May 2007		Harvest soil temp: 19 °C Elevation: 180 m						Soil type: sandy loam Row spacing: 75 cm					
Entry & tuber* characteristics	Spacing (cm)	Yield (t/ha)						Yield rank By Fry Grade	Tuber		Quality		
		Emergence (%)	Chats 0-100 g	Small 100-280 g	Medium 280-450 g	Large >450 g	Fry grade >100 g		no. per plant	Av mkt wt (g)	SG	Crisp# colour	Flesh faults† (%)
<b>Selection criteria</b>													
<b>Suitable</b>											1.078		
<b>MacRusset</b>	37	98	2.3	22.4	12.5	2.5	37.4	4	6.7	213	1.079	5	0
<b>Monaro</b>	25	77	1.2	15.1	16.5	10.7	42.4	3	4.8	268	1.079	5	12† fl, hh
<b>Ranger Russet</b>			5.1	32.5	14.2	2.2	48.9	2		205	1.078	4	0
<b>98-107-13</b>	25	84	1.1	26.0	20.2	7.4	53.6	1	5.6	251	1.083	5	0

\* 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.

† Significantly different percentage compared to Ranger Russet; f = fleck, s = stem end rot, v = vascular stain, h = hollows, o = other.

### 5.3. "01" and "02" series of breeding lines

#### 5.3.1 Background

The "01" and "02" series of breeding lines that were selected from the 2005-06 summer grown replicated screening (Dawson & Mortimore 2006) were tested in a district trial which led, in the following season, to a demonstration. The selection priority is for blemish free, low ACD varieties for summer production at Manjimup/Pemberton. See Section 4.4 for full selections criteria.

#### 5.3.2 November planted district trial at Pemberton 2006-07

##### Aims

To select fresh market and export-crisp breeding lines from the "01" and "02" series of breeding lines selected in a previous replicated screening (Dawson & Mortimore 2006) in a district trial planted in a commercial seed crop at Pemberton in 2006/07.

##### 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 5.3.2.1. The trial grew well with high rates of emergence for most entries; Nadine was the exception with only 76% emergence (Table 5.3.2.1). Yield were reasonable with the standard variety Nadine producing 63 t/ha marketable yield and Coliban yielding 67 t/ha.

To be selected for further evaluation entries had to have:

- suitable tuber characteristics,
- yield > 49.8 t/ha (not highly significantly less (P=0.01) than Nadine)
- specific gravity > 1.062 (highly significantly greater (P=0.01) than Nadine),
- ACD ≤ 2.1 (not significantly greater (P=0.05) than Nadine),
- slough ≤ 1.8 (not significantly worse than Nadine),
- acceptable fry colour (≤ 7), and
- no other major faults were allowed.

The sole selection was 00-6-24. In its previous test at Margaret River 00-6-24 had significantly lower ACD than Nadine, significantly higher specific gravity, similar slough score and significantly lower fry colour (Dawson & Mortimore 2006).

The main reason for the rejection of other entries was after-cooking-darkening with six of the ten entries cooking too dark after boiling. Five of these six rejections also had other faults.

**Table 5.3.2.1. Yield and quality of fresh market entries in a November 2006 planted district trial at Pemberton. 3 replications used. Grower R Falcinella, Pemberton, WA**

Planted 27 November 2006, harvested 2 April 2007		Harvest soil temp: 19°C		Soil type: sandy loam		Elevation: 200 m		Row spacing: 75 cm									
Entry & tuber* characteristics	Spacing (cm)	Yield (t/ha)					Yield rank Grade No.1	Over size >450 g	Tuber			Quality					
		Emergence (%)	Chats	Small 70-120 g	Medium 120-350 g	Large 350-450 g			Grade No.1	no. per plant	Av mkt wt (g)	SG	ACD	Slough-	Mash	Fry#	Flesh faults† (%)
<b>Selection criteria</b>																	
Suitable						>49.8					≥1.062	≤2.1	≤1.8		≤7		
<b>Billabong</b>	24	97	6.9	15.4	31.6	0.7	47.7	0.0	10	9.3	135	1.070	2.8	1.0	2.3	5.0	0
Coliban	15	100	3.3	9.5	55.1	2.1	66.7	0.3	1	5.1	183	1.068	2.0	1.5	1.5	5.7	0
<i>Delaware</i>	20	98	3.0	7.5	42.6	3.6	53.7	0.3	8	6.2	171	1.072	2.8	1.0	2.3	7.0	0
<b>Nadine</b>	24	76	5.3	12.6	48.8	1.7	63.0	0.3	3	13.2	155	1.055	1.2	1.0	3.0	9.0	3 fleck
<b>98-4-5</b>	15	97	7.2	12.2	43.6	2.7	58.5	0.4	5	6.5	149	1.061	1.8	1.0	2.8	6.7	0
<b>98-4-5</b>	20	92	6.3	11.1	41.0	2.3	54.3	1.0	7	8.4	157	1.061	2.7	1.0	3.7	6.7	0
<b>98-4-5</b>	24	97	4.7	9.7	46.9	1.9	58.5	1.3	4	8.8	165	1.060	2.7	1.5	2.7	7.0	0
<b>00-06-24</b>	24	91	4.5	12.0	41.2	1.3	54.5	1.0	6	9.5	153	1.068	1.2	1.8	2.5	6.3	0
<b>01-34-18</b>	24	98	4.9	14.6	36.1	0.7	51.4	0.0	9	9.0	137	1.077	2.8	1.3	2.8	6.3	0
<i>02-37-1</i>	24	98	4.6	10.6	51.6	1.1	63.3	0.0	2	9.3	165	1.075	1.7	2.5	2.8	7.0	0
<b>02-76-13</b>	24	83	3.8	8.1	28.8	4.2	41.1	2.0	12	7.7	176	1.066	3.0	2.3	4.0	6.0	0
<i>02-87-11</i>	30	97	5.9	9.6	35.1	1.0	45.7	0.0	11	10.2	153	1.068	2.8	1.5	1.5	5.7	0
Significance+		***	**	**	**	ns	**	ns		***	**	***	***	***	**	***	ns
LSD P = 0.05		5.0	1.9	3.9	11.7		10.9			1.5	22	0.006	0.9	0.7	1.1	1.1	
LSD P = 0.01							13.2					0.007		0.8			

\* 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.

† Flesh faults; † indicates significantly different internal disorders from Nadine; f = fleck, s = stem end rot, v = vascular stain, h = hollows, o = other.

+ "skew" indicates data did not fulfil assumptions of analysis of variance.



### *Crisps for export*

Breeding lines which were characterised as suitable for crisp processing, according to tuber characteristics, are shown in Table 5.3.2.2. Emergence rates of crisp entries were high with most having 93-100% emergence; exceptions were Atlantic with just 53% emergence and 01-55-10 with 82% emergence.

To be selected for further evaluation entries had to have:

- suitable tuber characteristics,
- yield >51.4 t/ha {not highly significantly ( $P = 0.01$ ) less than Bliss},
- specific gravity greater than 1.084 {not significantly less ( $P = 0.05$ ) than Bliss},
- fry colour not significantly darker than Atlantic,
- internal faults not significantly greater than Atlantic, and
- no other major faults.

The sole selection was Bliss. Five of the eight entries were rejected for low specific gravity but all of these had other faults. 00-58-1 was rejected solely on yield of 42.8 t/ha. In a previous test in a replicated screening of crisp varieties 00-58-1 also had marginal yield (Dawson & Mortimore 2006). We used Bliss (90-2-6) as the benchmark for some of the selection criteria whereas in previous tests we used Atlantic. This has led to more rigorous selection criteria because of Bliss' higher specific gravity and yield. This meant that Atlantic was not selected as its specific gravity did not meet the new benchmark.

**Table 5.3.2.2. Yield and quality of crisp processing entries in a November 2006 planted district trial at Pemberton. 3 replications used. Grower R Falcinella, Pemberton, WA**

Entry & tuber* characteristics		Spac- ing (cm)	Yield (t/ha)					Yield rank		Tuber			Quality					
		Emerg -ence (%)	Chats	Small 70-120 g	Med- ium 120-350 g	Large 350-450 g	Grade No. 1 70-450 g	Over size >450 g	rank Grade No.1	no. per plant	Av mkt wt (g)	SG	ACD	Sloug-	Mash	Fry#	Flesh faults† (%)	type
<b>Selection criteria</b>																		
							>53.8				>1.084	<20						
<i>Atlantic</i>	15	52	2.3	5.2	44.7	4.2	54.1	3.5	3	8.1	186	1.079	2.2	2.5	2.5	5.0	20†	f h
<b>Bliss</b>	20	98	4.7	16.1	43.8	0.2	60.1	0.0	1	8.3	138	1.089	1.8	3.7	1.7	5.0	0	
<b>Forester</b>	24	100	8.3	18.7	26.1	0.0	44.9	0.0	4	10.0	122	1.083	2.7	1.8	1.3	5.3	0	
<b>00-15-40</b>	40	98	15.5	14.6	7.4	0.0	22.0	0.0	8	18.4	100	1.084	1.2	1.2	2.2	4.7	0	
<b>00-58-1</b>	24	100	13.2	26.4	16.1	0.0	42.5	0.0	5	12.3	109	1.086	3.3	1.8	2.3	6.0	0	
01-55-10	30	82	3.7	6.6	24.2	1.0	31.8	0.0	7	8.4	149	1.077	3.0	1.2	2.5	6.0	0	
<b>01-82-18</b>	40	93	15.0	19.2	17.0	0.0	36.3	0.0	6	22.1	109	1.085	2.5	3.0	3.2	5.7	3	
02-29-5	24	93	5.7	13.2	39.0	3.2	55.5	0.3	2	9.6	153	1.074	3.2	1.5	2.2	6.0	0	
Significance+		***	***	***	***	***	***	***		***	***	***	***	***	ns	ns	*	
P=0.05		10.9	2.9	4.4	6.8	1.5	6.3	0.9		2.2	17	0.006	0.7	0.7				
P=0.01							8.7					0.008						

\* 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.

† Flesh faults; † indicates significantly different internal disorders from Bliss; f = fleck, s = stem end rot, v = vascular stain, h = hollows, o = other.

+ "skew" indicates data did not fulfil assumptions of analysis of variance.

### 5.3.3 November planted seed plots at Margaret River 2006-07

#### Aims

To produce high quality seed of entries growing in the District Trial and Demonstration. Also to maintain seed of more advanced breeding lines held by the WA variety evaluation program. Breeding lines being evaluated past the replicated screening stage must be bulked in a suitable seed area to supply seed for later tests.

#### Results

The seed plots were planted on 23 October 2006. The breeding lines bulked are shown in Table 5.3.3. The seed plots were inspected by officers from the Agwest PLANT LABORATORIES of DAFWA on 29 November 2006. All plots were accepted. The registered areas were 46590, 46591, 46610, 46611 and 46612. The DAFWA reference number was ASQ14475.

**Table 5.3.3. Potato breeding lines selected for seed bulking 2006/07.**

Plot	Entry	Comments
1	Auski	Advanced fresh market variety
2	Eben	Export variety
3	Maris Piper	Advanced fresh market variety
4	My Fry	French fry variety
5	PO3	Export variety
6	White Star	Advanced winter fresh market variety
7	97-102-1 (Monaro)	French fry
8	98-4-5 (Michaela)	Summer fresh market
9	98-107-13	French fry
10	98-34-11 (Flame)	Winter fresh market red
11	99-23-11 (Forester)	Crisp line
12	00-6-24	Fresh market
13	00-15-40	Crisp
14	00-58-1	Crisp
15	01-34-18	Fresh market
16	01-55-10	Crisp line
17	01-82-18	Crisp line
18	02-29-5	Crisp line
19	02-37-1	Fresh market
20	02-76-13	Fresh market
21	02-87-11	Fresh market

#### **5.3.4. Demonstration of fresh varieties 2007-08**

##### **Aim and background**

To select entries that merit commercial testing for summer production in the Manjimup/Pemberton region. Entries were selected from a November 2006 planted district trial at Pemberton (Section 5.4.2). Breeding lines from the “00” and “02” series were tested. Entries are shown in Table 5.3.4.

##### **Results**

The demonstration was planted in mid November and grew well with no disease or insect damage. However the Christmas and New Year period was extremely hot which caused some plant damage. The trial was sprayed off with farmer’s crop 11 March. The standard variety Nadine produced 48.9 t/ha of Grade No 1 tubers (Table 5.3.4).

To be selected entries had to have similar yield and appearance to Nadine with improved culinary quality. Although 00-6-4 and 02-37-1 had better yield and improved culinary quality (higher specific gravity, lighter fry colour, better mash quality though slightly higher slough scores) their appearance was not as good. 00-6-4 had better appearance than 02-37-1 but it only scored questionable tuber characteristics due to susceptibility to blemish disease (black dot?). This demonstration has confirmed 00-6-24 has improved culinary quality over Nadine with similar yield. However the demonstration has shown that 00-6-24 is more susceptible to skin blemish disease and therefore is not a contender to challenge Nadine for summer production in the South West.

**Table 5.3.4. Yield and quality of fresh market entries in a November 2007 planted demonstration at Pemberton.**

Entry, tuber characteristics* & spacing in row		Yield (t/ha)						Rank by Grade	Tuber no per plant	SG	Quality				Flesh† faults (%)	% skin bloom (14 days)
(cm)		Chats	Small	Med-ium	Large	Grade No 1	Over size >450 g	No 1			Cooking tests#					
		0-70 g	70-120 g	120-350 g	350-450 g	70-450 g	>450 g				ACD	Slough	Mash	fry		
Suitable		≥50								>1.060						
<i>Delaware</i>	20	3.8	6.2	17.3	0.9	24.4	0.2	4	6.2	1.070	1.0	1.5	1.5	7	6	0
<b>Nadine</b>	25	6.8	11.3	35.1	2.6	48.9	2.1	3	13.3	1.051	1.5	1.0	3.0	10	10	20
00-6-24	25	7.7	15.9	37.4	0.7	54.0	0.4	2	13.2	1.065	1.5	1.5	2.0	5	0	4
02-37-1	25	4.0	7.1	46.0	5.3	58.4	2.0	1	10.7	1.062	1.5	1.0	2.0	7	4	12
Significance															*	

\* Tuber characteristics: **bold** face = suitable, plain = questionable, *italic* = unsuitable.

† Flesh faults; † indicates significantly different internal disorders from Delaware.

## **5.4 “03” series of breeding lines**

### **5.4.1 Background**

Breeding lines of the “03” series from the DPIV-PBP were tested. One replicated screening was completed as well as the subsequent district variety trial.

### **5.4.2 Replicated summer screening 2006-07**

#### **Aims**

To select fresh market and crisp export breeding lines from the "03" series of breeding lines in a replicated screening in a commercial seed crop at Margaret River in 2006/07.

#### **Results**

Breeding lines previously selected for both the crisp and fresh market were planted together.

#### *Fresh market*

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 questionable or suitable tuber characteristics, specific gravity greater than 1.059 (significantly greater than Nadine,  $P = 0.05$ ), ACD less than 3, slough less than 2, acceptable fry colour (less than or equal to 7) with no other major faults.

The two selections were made for testing in the following season’s replicated district trial. These were 03-28-2 and 03-66-3. 03-66-3 was classified as a French fry as it had netted, light brown skin.

#### *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 were as follows: entries had to have suitable or questionable tuber characteristics, yield greater than 44.5 t/ha (not significantly lower than Bliss), specific gravity greater than 1.077 (not highly significantly less than Bliss ( $P = 0.01$ )) with acceptable fry colour and internal faults not significantly greater than Atlantic. No other major faults were allowed.

There were no selections meeting all these criteria. However 03-4-1 and 03-4-10 only were rejected for specific gravity just below the specific gravity selection criterion, so it was decided to select these two breeding lines.

**Table 5.4.2.1. Yield and quality of fresh market entries in an October 2006 planted replicated screening at Margaret River, WA. 2 replications used. Grower A. Darnell.**

Planted 25 October 2006, harvested 8 March 2007		Harvest soil temp: 22°C			Soil type: sandy loam			Elevation: 20 m			Row spacing: 75 cm									
Entry	Spac	Yield (t/ha)				Tuber				Quality										
& tuber* characteristics	ing (cm)	Emerg	Mat-urity	Dorm-ancy	Chats	Small	Med-ium	Large	Grade	Over	Rank	No.	Av	SG	ACD	Sloug-	Mash	Fry#	Flesh faults†	
		-ence (%)	(weeks)		0-70 g	70-120 g	120-350 g	350-450 g	No. 1	size >450 g	Grade No.1	per plant	mkt wt (g)						(%)	type
		Selection Criteria																		
? or suitable		>17.7						>1.059			<3		≤2		≤7					
<b>Billabong</b>	30	100			11.1	17.8	19.1	0.0	36.9	0.0	14	13.6	107	1.074	3.8	1.5	1.3	4.0	0	
<b>Cherry Red</b>	24	98			8.3	16.2	19.8	0.0	36.0	0.0	16	9.4	121	1.068	3.8	2.0	3.0	7.0	20	S h
<b>Coliban</b>	15	97			9.6	16.5	34.8	0.7	52.0	0.0	3	8.0	124	1.062	4.0	2.3	4.0	5.5	0	
<i>Delaware</i>	20	99			10.1	21.2	27.0	0.0	48.2	0.0	6	9.8	118	1.065	3.0	1.0	3.5	7.0	0	
Desiree	20	100			12.3	19.9	31.1	0.0	51.0	0.0	4	10.4	120	1.069	3.0	1.5	1.5	6.5	0	
Mondial	15	86			18.8	16.2	19.7	0.0	35.9	1.1	17	10.7	116	1.059	3.0	1.0	2.3	6.5	0	
<b>Nadine</b>	24	90			8.7	16.5	25.1	1.4	43.0	0.0	10	11.5	123	1.052	1.5	1.0	2.8	9.0	0	
Ruby Lou	20	97			15.2	20.8	12.5	0.0	33.3	0.0	21	10.6	102	1.064	3.3	1.3	1.3	5.5	30+	f h
<i>Russet Burbank</i>	40	100			11.4	14.5	14.8	0.0	29.3	0.0	24	19.0	106	1.070	2.5	1.5	1.8	6.0	0	
<b>98-4-5</b>	24	98			9.6	14.5	28.7	0.0	43.1	0.0	9	11.1	118	1.056	2.8	1.3	2.8	7.0	0	
<i>02-1-1</i>	24	95			12.4	21.2	37.5	0.3	59.0	0.0	2	13.8	130	1.076	2.5	2.0	3.0	5.0	0	
<i>02-18-2</i>	24	87			3.9	6.7	37.3	1.9	45.9	1.4	7	8.4	171	1.056	3.5	1.3	3.0	5.5	0	
<i>03-1-2</i>	30	88			11.2	10.3	18.9	0.0	29.2	0.0	25	13.5	120	1.072	4.0	1.8	3.8	4.5	0	
<i>03-4-11</i>	30	92			13.5	23.9	12.3	0.0	36.2	0.0	15	16.7	101	1.065	3.8	1.8	2.0	4.0	0	
<b>03-7-3</b>	24	95			12.2	16.5	14.1	0.0	30.6	0.0	22	11.7	106	1.079	3.5	1.0	2.3	4.0	0	
<b>03-12-4</b>	24	100			12.7	19.3	30.7	0.0	50.0	0.0	5	13.5	127	1.059	3.5	1.0	3.5	6.5	0	
<b>03-12-8</b>	24	100			7.7	12.7	26.0	1.4	40.1	0.0	12	9.5	136	1.054	3.5	1.0	4.0	6.5	10	f
<i>03-18-4</i>	24	100			14.3	15.4	14.0	0.0	29.4	1.1	23	12.5	110	1.063	2.8	1.3	3.5	7.0	0	
<b>03-19-8</b>	24	82			7.7	11.9	15.6	0.0	27.5	0.0	26	9.2	117	1.055	2.5	1.0	4.0	8.0	10	f
<i>03-19-20</i>	24	100			16.1	19.9	15.3	0.0	35.2	0.0	18	12.5	108	1.065	3.3	1.0	2.0	5.0	10	f
<b>03-28-2</b>	24	100			12.7	23.7	20.5	0.0	44.1	0.0	8	12.8	109	1.064	2.8	1.0	1.0	5.5	0	
<b>03-46-14</b>	30	98			16.8	21.7	15.5	0.0	37.3	0.0	13	17.3	106	1.062	3.0	1.0	2.8	4.5	0	
<i>03-47-1</i>	24	98			5.2	12.3	45.3	1.7	59.4	0.4	1	9.5	154	1.065	3.5	1.8	1.5	6.0	0	
<b>03-55-2</b>	30	100			10.5	17.7	23.9	0.0	41.6	0.0	11	13.6	121	1.056	2.8	2.3	1.0	6.5	0	
<b>03-56-3</b>	24	98			10.1	14.6	19.5	0.0	34.2	0.0	20	10.1	109	1.066	3.0	1.5	2.8	5.5	0	
<b>03-66-3</b>	30	100			5.3	14.7	19.6	0.0	34.3	0.0	19	9.5	120	1.074	2.5	1.5	1.3	5.5	0	
Significance+		ns			*	**	ns	*	ns		***	***	***	*	*		***	***		
LSD P = 0.05						8.6	14.1		18.7			3.3	22	0.005	1.1	0.8	1.0	1.4		
LSD P = 0.01									25.3					0.007						

\* @ ~ # † + See key under next table Table 5.5.1.C.

**Table 5.4.2.2. Yield and quality of crisp processing entries in an October 2006 planted replicated screening at Margaret River, WA. 2 replications used. Grower A. Darnell.**

Planted 25 October 2006, harvested 8 March 2007		Harvest soil temp: 22°C			Soil type: sandy loam			Elevation: 20 m			Row spacing: 75 cm									
Entry	Spac	Yield (t/ha)							Tuber			Quality								
& tuber* characteristics	ing (cm)	Emerg	Mat-urity	Dorm-ancy	Chats	Small	Med-ium	Large	Grade No. 1	Over size >450 g	Rank Grade No.1	No. per plant	Av mkt wt (g)	SG	ACD	Sloug-	Mash	Fry#	Flesh faults (%)	type
		(%)	(weeks)	0-70 g	70-120 g	120-350 g	350-450 g	450 g												
Suitable		Selection Criteria							>44.5			>1.077								
<b>Atlantic</b>	15	96			6.4	16.6	40.0	0.3	56.9	0.0	4	6.9	133	1.078				4.0	20	fl, hh
<b>Bliss</b>	20	96			3.9	12.4	47.6	0.7	60.6	0.4	3	7.9	154	1.084				4.5	10	hh
<b>03-4-1</b>	30	100			6.5	16.0	51.0	1.0	68.0	0.0	2	14.4	146	1.077				5.0	10	hh
<b>03-4-10</b>	24	97			7.9	13.9	55.1	1.1	70.0	0.0	1	12.8	151	1.075				5.5	10	hh
03-5-26	24	98			26.5	18.1	5.3	0.0	23.4	0.0	10	17.9	94	1.093				5.0	0	
03-6-2	30	96			7.4	12.0	11.1	0.0	23.1	0.0	11	8.7	109	1.078				5.5	0	
03-6-4	24	97			11.6	11.2	10.1	0.0	21.4	0.0	12	9.5	110	1.070				4.5	0	
<b>03-7-3</b>	24	95			12.2	16.5	14.1	0.0	30.6	0.0	6	11.7	106	1.079				4.0	0	
03-7-22	30	96			14.9	15.1	9.1	0.0	24.2	0.0	8	15.4	99	1.087				4.0	0	
03-7-25	24	100			12.5	12.9	10.9	0.0	23.8	0.0	9	10.1	106	1.076				5.5	0	
03-7-27	24	97			17.0	10.4	4.6	0.0	14.9	0.0	13	11.9	94	1.078				5.0	0	
03-19-20	24	100			16.1	20.0	15.3	0.0	35.3	0.0	5	12.5	108	1.065				5.0	10	fl
03-21-10	24	95			10.1	3.0	1.3	0.0	4.3	0.0	14	6.4	85	1.071				5.0	0	
03-43-2	24	95			7.8	12.6	12.0	0.0	24.6	0.0	7	8.1	113	1.061				6.0	0	
Significance+	ns				ns	***	ns	***	ns	***	***	***						ns	ns	
LSD P = 0.05						13.3		16.2		2.8		20	0.006							
LSD P = 0.01								19.8					0.008							

\* Tuber characteristics: **bold** typeface = suitable, plain type = questionable, *italic* = unsuitable. Skin colour shown if not white or cream.

@ 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.

† Significantly different internal disorders to either Nadine or Atlantic; f = fleck, s = stem end rot, v = vascular stain, h = hollows, o = other.

+ "skew" indicates data did not fulfil assumptions of analysis of variance.



### 5.4.3 November planted District trial at Pemberton 2007-08

#### Aims

To test in a district trial in a commercial crop at Pemberton in 2007/08 the fresh market and export-crisp breeding lines from the "03" series of breeding lines which had been selected in a previous replicated screening (Section 5.4.2). One "02" series breeding line, 02-37-1, was also tested. This was rejected from the 2006-07 district trial (see Section 5.3.2) but earlier tests showed much better results (Dawson & Mortimore 2006) and so was re-tested.

#### 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 the top section of Table 5.4.3. The trial grew well with high rates of emergence for all entries except Coliban with only 78% emergence (Table 5.4.3). The Christmas and New Year period was extremely hot causing some plant damage. The trial was sprayed off with the surrounding farmer's crop on 11 March 2008. No leaf diseases or insect problems were encountered. Yield were reasonable with the standard variety Nadine producing 70 t/ha marketable yield and Coliban yielding 50 t/ha.

To be selected for further evaluation entries had to have:

- suitable or questionable tuber characteristics,
- yield > 39.0 t/ha (not highly significantly less ( $P=0.01$ ) than Nadine)
- specific gravity > 1.061 (significantly greater ( $P=0.05$ ) than Nadine),
- ACD  $\leq 1.76$  (not significantly greater ( $P=0.05$ ) than Nadine),
- acceptable slough score ( $\leq 3$ ),
- acceptable fry colour ( $\leq 7$ ), and
- no other major faults were allowed.

No entries met the selection criteria. The main reason for rejection was ACD with five of the nine entries cooking too dark after boiling. Four entries were also rejected for low yield while two had significantly greater internal faults than Nadine.

##### *Crisps for export*

Breeding lines characterised as suitable for crisp processing, according to tuber characteristics, are shown in the lower section of Table 5.4.3. Emergence rates were high; 90% emergence or more. Growth was as described for the "fresh market" above. Yield were reasonable with the standard variety Atlantic producing 53 t/ha crisp yield and Bliss yielding 70 t/ha.

To be selected for further evaluation entries had to have:

- suitable tuber characteristics,
- yield > 29.8 t/ha (not significantly ( $P = 0.05$ ) less than Atlantic),
- specific gravity greater than 1.069 (not significantly less ( $P = 0.05$ ) than Atlantic),
- fry colour not highly significantly ( $P = 0.01$ ) darker than Atlantic,
- internal faults not significantly greater than Atlantic, and
- no other major faults.

The only entry meeting these criteria was Bliss.

**Table 5.4.3. Yield and quality of fresh market entries in a November 2007 planted district trial at Pemberton, WA. 3 replications used. Grower D Ryan.**

Planted 14 November 2007, harvested 9 April 2008				Harvest soil temp: 17°C				Soil type: sandy loam				Elevation: 200 m				Row spacing: 75 cm				
Entry & tuber* characteristics	Spacing (cm)	Yield (t/ha)							Tuber				Quality							
		Emerg-ence (%)	Mat-urity (weeks)	Dorm-ancy	Chats 0-70 g	Small 70-120 g	Med-ium 120-350 g	Large 350-450 g	Grade No. 1 70-450 g	Over size >450 g	Rank Grade No.1	No. per plant	Av mkt wt (g)	SG	ACD	Sloug-	Mash	Fry#	Flesh faults (%)	type
<b>FRESH MARKET</b> ? or suitable		<b>Fresh Selection Criteria</b> > 39.0										1.061	1.76	<8						
<i>Coliban</i>	15	78	17	18	8.5	13.3	34.8	2.3	50.4	1.0	5	8.8	135	1.063	2.00	2.0	2.7	4.17	20	
<i>Delaware</i>	20	100	17	20	3.2	4.1	13.0	0.5	17.5	0.0	9	3.6	124	1.065	1.33	1.3	2.7	6.83	27	
<b>Nadine</b>	24	100	17	16	13.0	25.0	41.0	4.1	70.0	1.2	1	15.9	131	1.054	1.00	1.0	1.0	9.00	17	
Ruby Lou (pink)	20	100	17	13	14.4	14.9	18.7	0.3	33.9	0.0	6	9.8	111	1.065	4.00	1.1	2.3	5.83	50†	fleck
<i>02-37-1</i>	24	100	17	16	6.3	11.4	45.4	5.9	62.7	1.9	4	10.6	159	1.065	1.67	2.2	1.5	6.17	0†	
<i>03-4-1 (light yellow)</i>	30	100	17	16	3.3	8.6	52.4	4.1	65.2	2.8	3	12.8	166	1.081	2.33	1.3	2.8	5.17	20	
<i>03-4-10</i>	24	100	17	16	6.2	10.6	54.0	4.4	69.0	2.0	2	11.2	161	1.080	2.33	1.5	4.0	4.83	27	
<i>03-28-2 (deep pink)</i>	24	100	17	10	14.2	11.0	20.5	0.5	31.9	0.0	7	10.8	125	1.065	2.00	1.0	2.2	5.67	50†	vasc
<i>03-66-3</i>	36	100	17	13	6.4	11.2	17.4	0.7	29.3	0.3	8	10.1	125	1.068	1.50	1.7	3.5	3.33	0†	
<b>03-66-3 (F fry)</b>																				
<b>CRISP</b> suitable		<b>Crisp Selection Criteria</b> > 29.8										1.069	3.73							
<b>Atlantic</b>	15	90	17	14	14.7	22.4	30.3	0.2	52.9	0.4	4	9.8	122	1.076	1.67	2.17	3.3	2.83	20	
<b>Bliss</b>	20	94	17	16	7.2	16.9	52.2	0.7	69.8	0.4	1	10.8	140	1.086	1.00	4.00	1.8	3.50	0†	
Ruby Lou	20	100	17	13	14.4	14.9	18.7	0.3	33.9	0.0	5	9.8	111	1.065	4.00	1.17	2.3	5.83	50†	
<i>03-4-1 (light yellow)</i>	30	100	17	16	3.3	8.6	52.4	4.1	65.2	2.8	3	12.8	166	1.081	2.33	1.33	2.8	5.17	20	
<i>03-4-10</i>	24	100	17	16	6.2	10.6	54.0	4.4	69.0	2.0	2	11.2	161	1.080	2.33	1.50	4.0	4.83	27	
Significance+		skew	-	***	***	***	***	skew	***	skew		***	***	***	***	***	***	***	*	
LSD P = 0.05				0.8	4.5	4.9	17.9	-	23.1	-		3.1	0.008	0.76	0.62	0.8	0.67			
LSD P = 0.01									31.0				0.010				0.90			

\* Tuber characteristics: **bold** typeface = suitable, plain type = questionable, *italic* = unsuitable. Skin colour shown if not white or cream.

@ 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.

† Significantly different internal disorders to either Nadine or Atlantic; f = fleck, s = stem end rot, v = vascular stain, h = hollows, o = other.

+ "skew" indicates data did not fulfil assumptions of analysis of variance.

#### ***5.4.4 November planted seed plots at Manjimup Horticultural Research Institute 2007-08***

##### **Background**

Advanced breeding lines selected in earlier variety evaluation projects and which were still undergoing testing in demonstrations or commercial strips must be bulked in a suitable seed area to supply seed for later tests. This seed was bulked under the WA Certified seed scheme over the summer of 2006/07.

##### **Aims**

To produce high quality seed of entries in the District Trial, Demonstration and more advanced tests of the WA variety evaluation program.

##### **Results**

The seed plots were planted in November 2007. The breeding lines and standard varieties bulked are shown in Table 5.4.4. This list does not include the breeding lines that were tested in the 2007 planted replicated and unreplicated screenings (Sections 5.5.5 and 5.6.3 respectively) as these screening plots supplied sufficient seed to maintain these breeding lines. The seed plots were inspected by officers from the Agwest PLANT LABORATORIES of the Department of Agriculture and Food, Western Australia 22 January 2008. All plots were accepted. The registered areas were 51070, 51071, 51072, 51073 and 51074. The DAFWA reference number was 14616.

**Table 5.4.4. Potato breeding lines seed bulking plots 2007/08.**

#	Entry	Market type*	Skin colour	Notes	Spacing (cm)
<b>Bulk A Seed of entries in district variety trial</b>					
1	Atlantic	c	lb	standard	15
2	Bliss	c	lb	standard	20
3	Coliban	w	w	E States standard white fresh market	15
4	Delaware	w	w		20
5	Nadine	w	c		24
6	Ruby Lou	w	lp	Standard red skin	20
7	03-4-1	c	y	From rep screen	30
8	03-4-10	c	y	From rep screen	24
9	03-28-2	w	p	From rep screen	24
10	03-66-3	ff	lb	From rep screen (French fry)	36
<b>Bulk B Seed of entries in demonstration</b>					
11	00-6-24	w	c(p)	Sole selection from district trial	24
12	02-37-1	w	c	Reject from previous dist trial but very good screening performance	24
<b>Bulk C Seed of entries in commercial tests and other standards</b>					
13	Auski	w			
14	Billabong	w			
15	Cherry Red	w			
16	Desiree	w			
17	Eureka	ff			
18	Flame (98-34-11)	w			
20	Maris Piper	w			
21	Mondial	w			
22	My Fry (89-27-6)	ff			
23	Russet Burbank	ff			
24	White Star	w			
25	97-102-1 (Monaro)	ff			
26	98-4-5 (Micheala)				
27	98-107-13	ff			
28	99-23-11 (Forester)				

\* w = ware (fresh market), c = crisp, ff = French fry

† b = brown, c = cream, cr = crimson, l = light p = pink, pu = purple r = red, w = white

## **5.5 “04” series of breeding lines**

### **5.5.1 Background.**

Breeding lines of the “04” series from the DPIV-PBP were tested. Both an unreplicated screening and its following replicated screening were completed. This resulted in the selection of six fresh market lines and one crisp breeding line for testing in a district trial scheduled to be planted in November 2008.

### **5.5.2 October 2006 planted unreplicated ware screening at Margaret River.**

#### **Aims**

1. To select entries suitable for the fresh market in an October planting at Margaret River. The entries comprise one “02” series breeding lines, three of the “03” series and 70 of the “04” series. These were compared with the standard or advanced varieties; Coliban, Delaware, Desiree, Dynamite, Mondial, Nadine, Ruby Lou and White Star.
2. To provide high quality seed for further tests.

#### **Results**

No PLRV, PVS, PVX, PVY or TSWV were detected in any of the breeding line tuber samples tested for virus. Breeding lines and their virus-free test numbers are shown in Table 5.5.2.1. The screening was planted on 23 October 2007 and emergence rates were high with plots averaging 90% emergence. Dynamite was the exception with only 50% emergence. The experiment grew well until spray-off two weeks prior to harvest on 6 March 2007.

74 entries were classified as fresh market types (Table 5.5.2.1). Selections had suitable or questionable tuber characteristics with specific gravity greater than or equal to 1.060 with ACD score or 3 or less, sloughing score of 2 or less and fry colour score of 7 or less. The 20 breeding lines selected for further testing in next season’s replicated screening are shown in bold typeface in Table 5.5.2.1.

The main faults causing rejection of entries were:

- unsuitable tuber characteristics which accounted for 39% (21/54) of rejections,
- after-cooking-darkening which accounted for 33 per cent (18/54) of rejections,
- low specific gravity which accounted for 9 per cent (5/54) of rejections, and
- sloughing which also accounted for 9 per cent (5/54) of rejections.

**Table 5.5.2.1. Virus test number, tuber characteristics, yield and quality of ware potato breeding lines in an October 2006 planted unreplicated screening at Margaret River. Selections shown in bold.**

Entry	Virus free test no.†	TC*	SG	Yield >80 g (t/ha)	Quality			Final selection & notes
					Crisp# colour	ACD	Slough	
Selection criteria								
		≥?	≥1.060		≤7	≤3	≤2	
<b>Coliban</b>	07/2026 07/2027	<b>Yes</b>	<b>1.071</b>	<b>0</b>	<b>5.0</b>	<b>3.0</b>	<b>1.0 yes</b>	
Delaware		no	1.068	51	8.0	3.5	1.0 no tc, fry, ACD	
Desiree	07/2020 07/2021	No	1.072	62	6.0	3.0	1.0 no tc	
<b>Dynamite</b>	07/1922	<b>yes</b>	<b>1.073</b>	<b>8</b>	<b>4.0</b>	<b>2.5</b>	<b>2.0 yes</b>	
Mondial		yes	1.065	31	8.0	2.5	1.0 no fry	
Nadine		yes	1.046	33	9.0	1.5	1.0 no SG	
Ruby Lou		yes	1.067	40	5.0	3.5	1.5 no ACD	
White Star		no	1.068	49	4.0	4.0	1.5 no tc, ACD	
02-80-6	06/1205	yes	1.068	76	4.0	3.5	1.5 no ACD	
03-59-7	07/2016	yes	1.060	43	7.0	2.5	1.5 no SG	
03-80-2	07/2017	no	-	-	-	-	no tc	
03-80-17	07/2018	yes	1.073	25	6.0	2.5	2.5 no slough	
04-131-5	07/1915	yes	1.081	31	4.0	3.5	1.5 no ACD	
04-141-4	07/1916	no	-	-	-	-	no tc	
04-170-7	07/1918	yes	1.054	22	7.0	1.5	1.5 no SG	
<b>04-170-10</b>	07/1920	<b>yes</b>	<b>1.059</b>	<b>19</b>	<b>3.0</b>	<b>1.5</b>	<b>1.5 yes despite SG</b>	
04-170-20	07/1921	no	-	-	-	-	no tc	
04-172-1	07/1923	yes	1.053	35	5.0	3.5	1.0 no SG, ACD	
04-172-2	07/1924	yes	1.056	42	6.0	3.5	1.5 no SG, ACD	
04-172-3	07/1925	yes	1.063	22	6.0	3.0	1.5 <b>yes</b>	
04-172-6	07/1926	no	-	-	-	-	no tc	
04-172-10	07/1927	yes	1.068	38	4.0	3.5	1.5 no ACD	
<b>04-172-13</b>	07/1928	<b>yes</b>	<b>1.061</b>	<b>62</b>	<b>3.0</b>	<b>3.0</b>	<b>2.0 yes</b>	
04-172-18	07/1929	yes	1.053	40	5.0	3.0	1.0 no SG	
04-172-19	07/1930	yes	1.064	53	5.0	3.0	2.5 no ACD, slough	
<b>04-172-24</b>	07/1932	<b>yes</b>	<b>1.060</b>	<b>45</b>	<b>5.0</b>	<b>3.0</b>	<b>2.0 yes</b>	
04-172-27	07/1933	no	-	-	-	-	no tc	
04-174-1	07/1935	no	-	-	-	-	no tc	
04-174-8	07/1936	no	-	-	-	-	no tc	
04-174-16	07/1937	no	-	-	-	-	no tc	
04-174-19	07/1938	yes	1.066	52	6.0	4.0	1.0 no ACD	
<b>04-174-22</b>	07/1940	<b>yes</b>	<b>1.053</b>	<b>39</b>	<b>6.0</b>	<b>2.5</b>	<b>1.5 yes</b>	
04-174-25	07/1942	yes	1.060	26	5.0	3.5	1.5 no ACD	
04-175-5	07/1945	no	-	-	-	-	no tc	
04-176-2	07/1947	yes	1.081	31	3.0	2.5	2.5 no slough	
04-176-3	07/1948	yes	1.077	57	4.0	1.5	4.0 no slough	
04-176-4	07/1949	no	-	-	-	-	no tc	
<b>04-176-7</b>	07/1950	<b>yes</b>	<b>1.072</b>	<b>29</b>	<b>5.0</b>	<b>3.0</b>	<b>1.0 yes</b>	

† 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

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**Table 5.5.2.1. continued. Virus test number, tuber characteristics, yield and quality of ware potato breeding lines in an October 2006 planted unreplicated screening at Margaret River. Selections shown in bold.**

Entry	Virus free test no.†	TC*	SG	Yield >80 g (t/ha)	Quality			Final selection & notes
					Crisp# colour	ACD	Slough	
Selection criteria								
		≥?	≥1.060		≤7	≤3	≤2	
04-176-8	07/1951	yes	1.066	54	3.0	3.5	2.0	no ACD
04-176-11	07/1952	yes	1.078	29	3.0	3.0	1.5	yes
04-176-12	07/1953	no	-	-	-	-	-	no tc
04-178-1	07/1954	no	-	-	-	-	-	no tc
04-178-3	07/1955	no	-	-	-	-	-	no tc
<b>04-178-13</b>	07/1956	<b>yes</b>	<b>1.077</b>	<b>12</b>	<b>4.0</b>	<b>3.0</b>	<b>1.0</b>	<b>yes</b>
04-179-2	07/1957	no	-	-	-	-	-	no tc
<b>04-181-1</b>	07/1958	<b>yes</b>	<b>1.065</b>	<b>28</b>	<b>5.0</b>	<b>1.5</b>	<b>2.0</b>	<b>yes</b>
<b>04-181-5</b>	07/1959	<b>yes</b>	<b>1.067</b>	<b>0</b>	<b>3.0</b>	<b>3.0</b>	<b>2.0</b>	<b>yes</b>
<b>04-182-3</b>	07/1960	<b>yes</b>	<b>1.062</b>	<b>54</b>	<b>6.0</b>	<b>2.5</b>	<b>1.0</b>	<b>yes</b>
04-182-6	07/1961	yes	1.062	10	4.0	3.5	1.5	no ACD
04-182-8	07/1962	no	-	-	-	-	-	no tc
04-182-9	07/1963	no	-	-	-	-	-	no tc
04-182-10	07/1964	no	-	-	-	-	-	no tc
04-182-13	07/1965	?	1.066	33	6.0	3.5	1.0	no ACD
04-182-14	07/1966	yes	1.069	0	5.0	4.0	1.5	no ACD
<b>04-182-20</b>	07/1967	<b>?</b>	<b>1.062</b>	<b>18</b>	<b>5.0</b>	<b>2.5</b>	<b>1.0</b>	<b>yes</b>
04-183-3	07/1968	no	-	-	-	-	-	no tc
04-183-5	07/1969	?	-	-	-	-	-	No not enough sample
04-185-1	07/1970	yes	1.067	34	3.0	2.5	2.0	<b>yes</b>
04-185-3	07/1971	yes	1.072	30	4.0	3.5	1.5	no ACD
04-187-1	07/1972	yes	1.066	14	7.0	3.5	1.5	no ACD
04-189-10	07/1974	yes	1.067	26	4.0	3.5	1.0	no ACD
04-189-12	07/1975	yes	1.081	58	7.0	2.5	2.5	no slough
04-193-1	07/1978	yes	1.07	53	4.0	3.5	1.0	no ACD
04-193-5	07/1979	no	-	-	-	-	-	no tc
<b>04-193-21</b>	07/1980	<b>yes</b>	<b>1.068</b>	<b>62</b>	<b>5.0</b>	<b>2.5</b>	<b>1.5</b>	<b>yes</b>
04-193-23	07/1981	no	-	-	-	-	-	no tc
<b>04-195-4</b>	07/1984	<b>?</b>	<b>1.073</b>	<b>48</b>	<b>3.0</b>	<b>3.0</b>	<b>1.0</b>	<b>yes</b>
<b>04-195-10</b>	07/1989	<b>?</b>	<b>1.071</b>	<b>18</b>	<b>4.0</b>	<b>1.0</b>	<b>1.0</b>	<b>yes</b>
<b>04-196-1</b>	07/1990	<b>yes</b>	<b>1.075</b>	<b>45</b>	<b>6.0</b>	<b>2.0</b>	<b>1.0</b>	<b>yes</b>
<b>04-196-2</b>	07/1991	<b>yes</b>	<b>1.072</b>	<b>41</b>	<b>5.0</b>	<b>2.0</b>	<b>1.5</b>	<b>yes</b>
04-196-3	07/1992	yes	1.064	29	7.0	1.5	1.0	no fry
04-196-5	07/1993	?	1.064	22	7.0	4.0	1.0	no fry, ACD
<b>04-197-5</b>	07/1995	<b>?</b>	<b>1.066</b>	<b>22</b>	<b>4.0</b>	<b>3.0</b>	<b>1.5</b>	<b>yes</b>
<b>04-197-8</b>	07/1996	<b>yes</b>	<b>1.063</b>	<b>35</b>	<b>5.0</b>	<b>3.0</b>	<b>1.5</b>	<b>yes</b>
04-200-7	07/1997	no	-	-	-	-	-	no tc

† AgWest Plant laboratories 2006 sample number. Full number = 07/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

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**Table 5.5.2.1. continued. Virus test number, tuber characteristics, yield and quality of ware potato breeding lines in an October 2006 planted unreplicated screening at Margaret River. Selections shown in bold.**

Entry	Virus Free Test no.†	TC*	SG	Yield >80 g (t/ha)	Quality			Final selection & notes
					Crisp# colour	ACD	Slough	
Selection criteria								
		≥?	≥1.060		≤7	≤3	≤2	
04-202-2	07/2004	no	-	-	-	-	-	no tc
<b>04-202-3</b>	07/2005	<b>yes</b>	<b>1.068</b>	<b>34</b>	<b>5</b>	<b>1.5</b>	<b>1.5</b>	<b>yes</b>
04-202-6	07/2008	no	-	-	-	-	-	no tc
04-202-9	07/2010	no	-	-	-	-	-	no tc
04-202-13	07/2012	yes	1.070	31	5	3.5	1.5	no ACD
04-203-6	07/2013	?	1.057	36	6	1.5	1.0	no SG
04-203-8	07/2014	no	-	-	-	-	-	no tc

† 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

#### After-cooking-darkening comparison between Toolangi and Margaret River

Before entries selected for this experiment they were screened for ACD using cooking data from the DPIV-PBP (Dawson & Mortimore 2006). Only breeding lines with ACD scores of 2 or less were selected for planting. The cooking results from this unreplicated screening (Table 5.5.2.1) showed that 18 breeding lines rejected for ACD score of greater than 3 even though all selections had scored  $\leq 2$  at Toolangi in the previous season. This indicates that ACD is more severe at Margaret River in WA than at Toolangi, Victoria. Table 5.5.2.2 shows that for the 48 varieties and breeding lines where ACD test data was available from both DPIV-PBP (2006) and DAFWA, 44 or 92% had darker ACD at Margaret River. This shows that strict selection using ACD cooking data from DPIV-PBP is sound and even stricter selection criteria might be usefully applied.

Selections will be re-tested next season in a replicated screening (see Section 5.5.5).



**Table 5.5.2.2. Comparison of after-cooking-darkening tests from DPIV 2006 and DAFWA 2007.**

Entry	ACD tests*		WA test result compared with DPIV	Entry	ACD tests*		WA test result compared with DPIV
	DPIV 2006†	DAFWA 2007			DPIV 2006†	DAFWA 2007	
Coliban	1.0	3.0	darker	04-181-5	2.0	3.0	darker
Desiree	1.0	3.0	darker	04-182-6	3.0	3.5	darker
Dynamite	1.0	2.5	darker	04-182-3	1.0	2.5	darker
04-131-5	1.0	3.5	darker	04-182-13	2.0	3.5	darker
04-170-7	1.0	1.5	darker	04-182-14	2.0	4.0	darker
04-170-10	1.0	1.5	darker	04-182-20	2.0	2.5	darker
04-172-1	1.0	3.5	darker	04-185-1	1.0	2.5	darker
04-172-2	1.0	3.5	darker	04-185-3	2.0	3.5	darker
04-172-3	1.0	3.0	darker	04-187-1	2.0	3.5	darker
04-172-10	1.0	3.5	darker	04-189-10	2.0	3.5	darker
04-172-13	1.0	3.0	darker	04-189-12	2.0	2.5	darker
04-172-18	1.0	3.0	darker	04-193-1	1.0	3.5	darker
04-172-19	1.0	3.0	darker	04-193-21	1.0	2.5	darker
04-172-19	2.0	3.0	darker	04-195-4	2.0	3.0	darker
04-174-19	2.0	4.0	darker	04-195-10	1.0	1.0	<b>same</b>
04-174-22	1.0	2.5	darker	04-196-1	2.0	1.0	darker
04-174-25	1.0	3.5	darker	04-196-2	2.0	1.0	darker
04-176-2	1.0	2.5	darker	04-196-3	2.0	1.5	<b>lighter</b>
04-176-3	2.0	1.5	<b>lighter</b>	04-196-5	2.0	4.0	darker
04-176-7	1.0	3.0	darker	04-197-5	2.0	3.0	darker
04-176-8	1.0	3.5	darker	04-197-8	1.0	3.0	darker
04-176-11	1.0	3.0	darker	04-202-3	2.0	1.5	<b>lighter</b>
04-178-13	1.0	3.0	darker	04-202-13	1.0	3.5	darker
04-181-1	1.0	1.5	darker	04-203-6	1.0	1.5	darker

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

† From Dawson & Mortimore (2006).

### 5.5.3. October 2006 planted unreplicated crisp screening at Margaret River.

#### Aims

1. To select entries suitable for the crisp market in an October planting at Margaret River. The entries comprise two “03” series of DPIV-PBP breeding lines and 52 of the “04” 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 5.5.2. 54 breeding lines were classified as crisp types (Table 5.5.3.1). Selections had suitable or questionable tuber characteristics with specific gravity greater than 1.080 with crisp fry colour less than 6.0. Selections are shown in bold typeface in Table 5.5.3.1.

**Table 5.5.3.1. Virus test number, tuber characteristics, yield and quality of crisp potato breeding lines in a October 2006 planted unreplicated screening at Margaret River. Selections shown in bold.**

Entry	Virus test no.†	TC*	SG	Yield >80 g (t/ha)	Quality			Final selection & notes
					Crisp# colour	ACD	Slough	
Selection criteria								
		≥ ?	>1.080	<6				
Atlantic	07/2024 07/2025	Yes	1.079	47	4	2.5	1.5	No SG
<b>Bliss</b> (ex Damell G2)		<b>yes</b>	<b>1.095</b>	<b>61</b>	<b>4</b>	<b>3.0</b>	<b>2.5</b>	<b>Yes</b>
Pike	07/2015	yes	1.074	38	4	2.5	1.5	No SG
Russet Burbank	07/2022 07/2023	No	1.076	38	5	2.5	2.5	No TC, SG
03-80-2	07/2017	no	-	-	-	-	-	No TC
03-80-20	07/2019	no	-	-	-	-	-	No TC
<b>04-122-1</b>	07/1912	<b>yes</b>	<b>1.081</b>	<b>38</b>	<b>4</b>	<b>3.5</b>	<b>1.0</b>	<b>Yes</b>
04-122-3	07/1913	no	-	-	-	-	-	No TC
<b>04-131-5</b>	07/1915	<b>yes</b>	<b>1.081</b>	<b>31</b>	<b>4</b>	<b>3.5</b>	<b>1.5</b>	<b>Yes</b>
<b>04-154-19</b>	07/1917	<b>?</b>	<b>1.083</b>	<b>38</b>	<b>5</b>	<b>3.0</b>	<b>1.5</b>	<b>Yes</b>
04-170-9	07/1919	no	-	-	-	-	-	No TC
04-172-1	07/1923	yes	1.053	35	5	3.5	1.0	No SG
04-172-19	07/1930	yes	1.064	53	5	3.0	2.5	No SG
04-172-22	07/1931	?	1.058	28	6	4.0	1.5	No SG, fry
04-172-24	07/1932	yes	1.060	45	5	3.0	2.0	No SG
04-172-27	07/1933	no	-	-	-	-	-	No TC
04-173-2	07/1934	no	-	-	-	-	-	No TC
04-174-16	07/1937	no	-	-	-	-	-	No TC
04-174-20	07/1939	no	-	-	-	-	-	No TC
04-174-23	07/1941	no	-	-	-	-	-	No TC
04-175-1	07/1943	?	1.078	17	5	2.5	1.5	No SG
<b>04-175-4</b>	07/1944	<b>yes</b>	<b>1.080</b>	<b>39</b>	<b>5</b>	<b>2.0</b>	<b>1.5</b>	<b>Yes</b>
04-175-9	07/1946	yes	1.078	31	5	3.5	1.5	No SG
<b>04-176-2</b>	07/1947	<b>yes</b>	<b>1.081</b>	<b>31</b>	<b>3</b>	<b>2.5</b>	<b>2.5</b>	<b>Yes</b>
04-176-3	07/1948	yes	1.077	57	4	1.5	4.0	No SG
04-181-1	07/1958	yes	1.065	28	5	1.5	2.0	No SG
04-181-5	07/1959	yes	1.067	0	3	3.0	2.0	No SG
04-182-9	07/1963	no	-	-	-	-	-	No TC
04-182-14	07/1966	yes	1.069	0	5	4.0	1.5	No SG
04-183-5	07/1969	?	-	-	-	-	-	No SG
04-185-1	07/1970	yes	1.067	34	3	2.5	2.0	No SG
04-185-3	07/1971	yes	1.072	30	4	3.5	1.5	No SG
04-188-2	07/1973	yes	1.066	79	4	2.5	2.5	No SG
04-192-1	07/1976	?	1.086	28	4	2.0	1.0	No SG
04-192-4	07/1977	no	-	-	-	-	-	No TC
04-193-1 (32)	07/1978	yes	1.070	53	4	3.5	1.0	No SG

† AgWest Plant laboratories 2006 sample number. Full number = 06/xxxx.

\* 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

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**Table 5.5.3.1. continued. Virus test number, tuber characteristics, yield and quality of crisp potato breeding lines in a October 2006 planted unreplicated screening at Margaret River. Selections shown in bold.**

Entry	Virus test no.†	TC*	SG	Yield >80 g (t/ha)	Quality			Final selection & notes
					Crisp# colour	ACD	Slough	
Selection criteria								
		≥ ?	>1.080		<6			
04-195-1	07/1982	yes	1.074	41	4	2.0	1.5	No SG
04-195-3	07/1983	yes	1.073	37	4	2.5	1.5	No SG
04-195-4	07/1984	?	1.073	48	3	3.0	1.0	No SG
04-195-5	07/1985	no	-	-	-	-	-	No TC
04-195-7	07/1986	yes	1.074	17	5	2.5	2	No SG
04-195-8	07/1987	no	-	-	-	-	-	No TC
04-195-9	07/1988	no	-	-	-	-	-	No TC
04-196-1	07/1990	yes	1.075	45	6	2	1	No SG, fry
04-196-2	07/1991	yes	1.072	41	5	2	1.5	No SG
04-201-1	07/1998	no	-	-	-	-	-	No TC
04-201-2	07/1999	no	-	-	-	-	-	No TC
04-201-6	07/2000	no	-	-	-	-	-	No TC
04-201-9	07/2001	no	-	-	-	-	-	No TC
04-201-10	07/2002	?	1.074	36	4	3	1.5	No SG
04-201-14	07/2003	no	-	-	-	-	-	No TC
04-202-2	07/2004	no	-	-	-	-	-	No TC
04-202-3	07/2005	yes	1.068	34	5	1.5	1.5	No SG
04-202-4	07/2006	yes	1.078	42	4	1	2	No SG
04-202-5	07/2007	no	-	-	-	-	-	No TC
04-202-8	07/2009	yes	1.076	64	4	1.5	2.5	No SG
<b>04-202-11</b>	07/2011	<b>yes</b>	<b>1.089</b>	<b>46</b>	<b>5</b>	<b>2.5</b>	<b>1.5</b>	<b>Yes</b>
04-202-13 (54)	07/2012	yes	1.070	31	5	3.5	1.5	No SG

† AgWest Plant laboratories 2006 sample number. Full number = 06/xxxx.

\* 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

Five 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 26 out of 54 or 48% of rejections, then unsuitable tuber characteristics which accounted for 21 out of 54 or 39% of rejections.

#### Specific gravity comparison between Toolangi and Margaret River

Entries were screened for specific gravity before planting (Dawson & Mortimore 2006) using cooking data from the DPIV-PBP selection plots harvest of 2006. The rejection of 48% of breeding lines due to low specific gravity indicates that the WA potato industry requires breeding lines with higher specific gravity level than is used in the eastern states. Table 5.5.3.2 shows that for 33 crisp entries lines where specific gravity data was available from both Victoria (2006 season) and WA (2007 season), 32 had lower specific gravity at Margaret River than at DPIV-PBP Toolangi. Specific gravity was converted to dry matter and a comparison made which showed that on average the WA test was only 89% of the dry matter

test result done in Victoria. A similar comparison for the previous season showed WA specific gravity measures were only 90% of the Victorian results (Dawson & Mortimore 2006). This shows that strict selection using specific gravity cooking data from DPIV-PBP is sensible and even stricter selection criteria might be usefully applied.

Selections will be re-tested next season in a replicated screening (See Section 5.5.5).

**Table 5.5.3.2 Comparison of specific gravity tests from DPIV 2006 and DAFWA 2007**

Entry	DPIV 2005 tests		DAFWA 2006 tests		WA/DPIV
	SG	Dry matter (%)†	SG	Dry matter (%)†	(%)
Atlantic	1.075	19.2	1.079	20.0	104
04-122-1	1.086	21.5	1.081	20.4	95
04-131-5	1.090	22.3	1.081	20.4	91
04-154-19	1.094	23.2	1.083	20.8	90
04-172-1	1.069	17.9	1.053	14.5	81
04-172-19	1.080	20.2	1.064	16.8	83
04-172-22	1.071	18.3	1.058	15.6	85
04-172-24	1.072	18.5	1.060	16.0	86
04-175-1	1.088	21.9	1.078	19.8	90
04-175-4	1.083	20.8	1.080	20.2	97
04-175-9	1.081	20.4	1.078	19.8	97
04-176-2	1.089	22.1	1.081	20.4	92
04-176-3	1.083	20.8	1.077	19.6	94
04-181-1	1.068	17.7	1.065	17.0	96
04-181-5	1.073	18.7	1.067	17.5	93
04-182-14	1.076	19.4	1.069	17.9	92
04-185-1	1.082	20.6	1.067	17.5	85
04-185-3	1.089	22.1	1.072	18.5	84
04-188-2	1.086	21.5	1.066	17.3	80
04-192-1	1.090	22.3	1.086	21.5	96
04-193-1	1.082	20.6	1.070	18.1	88
04-195-1	1.095	23.4	1.074	18.9	81
04-195-3	1.097	23.8	1.073	18.7	79
04-195-4	1.088	21.9	1.073	18.7	86
04-195-7	1.093	23.0	1.074	18.9	83
04-196-1	1.085	21.3	1.075	19.2	90
04-196-2	1.084	21.1	1.072	18.5	88
04-201-10	1.081	20.4	1.074	18.9	93
04-202-3	1.085	21.3	1.068	17.7	83
04-202-4	1.084	21.1	1.078	19.8	94
04-202-8	1.090	22.3	1.076	19.4	87
04-202-11	1.097	23.8	1.089	22.1	93
04-202-13	1.081	20.4	1.070	18.1	89
Average					89

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

**5.5.4. October 2006 planted unreplicated multi-purpose French fry screening at Margaret River.**

**Aims**

- 1 To select multipurpose entries suitable for both the French fry and fresh market in an October planting at Margaret River. The entries comprise one “02” series of breeding lines plus two of the “04” 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 5.5.2. Three entries were classified as French fry types (Table 5.5.4). Selections had suitable tuber characteristics with specific gravity greater than or equal to 1.075 with crisp fry colour less than 6.0. Selections are shown in bold typeface in Table 5.5.4. Two breeding line was selected for further testing in next season’s replicated screening.

**Table 5.5.4 Virus test number, tuber characteristics, yield and quality of French fry potato breeding lines in an October 2006 planted unreplicated screening at Margaret River. Selections shown in bold.**

Entry	Virus test no.†	TC*	SG	Yield >80 g (t/ha)	Quality			Final selection & notes
					Crisp# colour	ACD	Slough	
Selection criteria								
Suitable		yes	>1.075		<6			
Dynamite	07/1922 07/1994	yes	1.073	8	4	2.5	2.0	
Russet Burbank	07/2022 07/2023	no	1.076	38	5	2.5	2.5	
02-80-6	06/1205	yes	1.068	76	4	3.5	1.5	
<b>04-25-8</b>	07/1903	<b>yes</b>	<b>1.079</b>	<b>31</b>	<b>4</b>	<b>3.0</b>	<b>2.0</b>	<b>yes</b>
<b>04-45-1</b>	07/1911	<b>yes</b>	<b>1.084</b>	-	<b>3</b>	<b>3.0</b>	<b>1.5</b>	<b>yes</b>

† AgWest Plant laboratories 2006 sample number. Full number = 06/xxxx.

\* 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

**5.5.5. November 2007 planted replicated screening at Manjimup Horticultural Research Institute.**

**Aims**

1. To select from the 21 breeding lines of the "04" series fresh market and crisp export breeding lines that merit testing in the 2008-09 season district trial.
2. To produce high quality seed for further tests.

**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 5.5.5.1.

The trial emerged well with most fresh market entries having 90% or greater emergence. Low emergence rates were seen in 04-97-8 (47%), 04-182-3 (58%) and 04-172-3 (54%). Growth was good despite the extreme Christmas period heat which damaged some plants. Average maturity of the entries was 15 weeks to 50% senescence. The trial grew well with average marketable yield of 50 t/ha with the highest plot yielding of 83 t/ha (Coliban). At harvest plots of 04-154-19 proved to be a mixture and so this breeding line was discarded and not assessed for yield or quality. Previously this line had been selected for crisp processing (see Section 5.5.3).

Selections had suitable or questionable tuber characteristics with specific gravity significantly greater than Nadine, ACD not significantly darker than Nadine and acceptable slough and fry colour with internal disorders not significantly different from Nadine. ACD was the most common cause of rejection affecting 18 entries. Seven entries were rejected for low yield. Selections were: Desiree, Dynamite, 04-172-13, 04-181-1, 04-193-21, 04-195-4 and 04-196-2 (purple skin). The "best bets", breeding lines with suitable tuber characteristics and white skin, were Dynamite, 04-193-21 and 04-195-4.

*Crisps for export*

Breeding lines which were characterised as suitable for crisp processing, according to tuber characteristics, are shown in Table 5.5.5.2.

Entries emerged well with most having 96% or greater emergence. Growth was good despite the extreme Christmas period heat which damaged some plants. Average maturity of the entries was 15 weeks to 50% senescence. Bliss and 04-202-11 matured at 16 weeks with 04-202-3 maturing one week later. Average crisp yield was 50.4 t/ha and Atlantic produced the greatest yield of 59.4 t/ha.

Selections had suitable tuber characteristics with specific gravity not significantly less than Atlantic ( $P = 0.05$ ), fry colour not significantly darker than Atlantic, yield not significantly lower than Atlantic and internal disorders not significantly greater than Atlantic. Selections were: Atlantic, Bliss and 04-195-4.

**Table 5.5.5.1. Yield and quality of fresh market entries in a November 2007 planted replicated screening at Manjimup Horticultural Research Institute, WA. 2 replications used.**

Planted 13 November 2007, harvested 18 March 2008				Harvest soil temp: 19°C				Soil type: sandy loam				Elevation: 260 m			Row spacing: 75 cm					
Entry	Spac	Yield (t/ha)				Tuber				Quality										
& tuber* characteristics	ing (cm)	Emerg	Mat-urity	Dorm-ancy	Chats	Small	Med-ium	Large	Grade	Over	Rank	No.	Av	SG	ACD	Sloug-	Mash	Fry#	Flesh	faults
		-ence (%)	(weeks)		0-70 g	70-120 g	120-350 g	350-450 g	No. 1	size >450 g	Grade No.1	per plant	mkt weight (g)						(%)	type
Suitable or ?able		Selection Criteria																		
		>41.9				>1.064			<1.92		<3		<8							
<b>Coliban</b>	15	95	16.0	14	5.8	13.2	58.0	4.9	76.1	1.3	1	7.8	156	1.075	2.3	2.5	2.0	3.5	0	
<i>Delaware</i>	20	100	16.0	21	6.3	16.0	53.8	3.4	73.3	1.4	2	9.9	153	1.079	2.3	2.5	2.0	7.3	10	v
Desiree (pink)	20	97	16.0	15	8.9	26.7	39.5	0.7	67.0	0.0	3	12.0	120	1.081	1.3	2.5	1.8	5.0	10	v
<b>Dynamite</b>	24	97	15.0	10	8.0	18.7	36.4	1.2	56.3	0.0	10	11.5	130	1.079	1.8	2.0	1.8	2.3	0	
<b>Cherry Red</b> (crimson)	24	82	15.0	12	3.4	9.3	42.3	2.1	53.7	0.4	12	9.8	157	1.077	4.5	2.5	2.8	6.0	0	
<b>Nadine</b> (std variety)	24	98	15.0	14	10.6	20.2	46.0	0.0	66.2	0.0	4	14.4	129	1.059	1.0	1.0	1.8	9.0	0	
Ruby Lou (pink std)	20	100	15.0	14	11.3	21.1	38.9	2.0	62.0	0.0	7	11.3	128	1.077	2.0	1.8	2.5	3.5	60†	v, f
<i>Russet Burbank (F fry)</i>	40	100	16.0	20	5.9	14.2	38.6	0.7	53.4	0.0	13	15.6	140	1.080	1.0	1.5	2.5	4.5	0	
04-25-8 (F fry)(1 br)	30	100	15.0	12	7.1	20.6	22.6	0.0	43.2	0.0	21	12.2	113	1.090	4.0	3.5	2.5	3.3	10	v
04-45-1 (F fry)	30	75	15.0	12	4.5	12.1	16.5	0.3	29.0	0.9	27	10.3	130	1.082	2.8	2.0	2.8	2.5	60†	f, v, h
White Star	30	100	15.0	14	4.8	20.4	38.3	0.0	58.7	0.0	9	15.1	123	1.074	2.8	1.5	1.5	3.0	0	
04-170-10 (v l pink)	24	73	15.0	15	4.8	11.2	31.1	2.9	45.3	1.5	19	11.2	145	1.062	1.0	1.3	2.5	4.0	0	
04-172-3	30	54	15.0	15	3.1	4.9	14.8	0.7	20.3	1.4	29	7.7	170	1.071	2.8	1.5	2.8	4.0	0	
04-172-13	24	97	15.0	15	6.5	16.8	47.3	0.7	64.8	0.0	5	12.3	139	1.072	1.5	1.5	4.0	2.5	10	v
<b>04-174-22</b>	30	92	15.0	11	4.7	11.5	36.9	0.7	49.2	0.4	16	11.4	143	1.062	3.0	1.3	2.3	6.8	10	v
<b>04-176-2</b> (c & w)	30	100	15.0	10	12.9	16.9	19.0	0.0	35.9	0.0	26	16.0	107	1.089	4.0	2.8	3.3	3.3	0	
<b>04-178-13</b> (pk c y eyes)	24	95	15.0	10	8.4	10.1	18.0	0.7	28.8	0.0	28	9.1	117	1.081	2.0	1.5	3.0	4.3	20	v
04-181-1	24	98	15.0	14	6.9	15.4	33.4	0.4	49.2	0.0	17	9.8	129	1.069	1.5	1.8	3.5	5.5	0	
04-181-5	24	97	15.0	14	1.7	3.9	30.7	1.7	36.3	0.0	25	5.5	173	1.070	3.8	2.0	2.5	3.8	10	v
04-182-3 (crimson)	24	58	17.0	10	3.2	5.6	31.6	4.8	41.9	1.9	22	10.2	186	1.068	3.8	1.5	3.0	4.0	0	
<b>04-182-20</b> (pink)	24	88	15.0	11	6.2	14.9	28.3	0.3	43.6	0.0	20	10.2	127	1.072	2.8	2.0	4.0	4.0	0	
<b>04-185-1</b> (pink blush)	24	97	15.0	17	13.9	25.8	13.2	0.0	39.0	0.0	24	11.6	97	1.077	1.5	1.5	2.5	3.0	20	f
<b>04-193-21</b>	24	95	17.0	25	2.3	7.2	41.6	5.1	53.9	4.3	11	7.2	191	1.071	1.8	1.5	4.0	4.5	0	

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**Table 5.5.5.1 continued. Yield and quality of fresh market entries in a November 2007 planted replicated screening at Manjimup Horticultural Research Institute, WA. 2 replications used.**

Planted 13 November 2007, harvested 18 March 2008		Harvest soil temp: 19°C			Soil type: sandy loam			Elevation: 260 m			Row spacing: 75 cm									
Entry	Spacing	Yield (t/ha)							Tuber			Quality								
& tuber* characteristics	(cm)	Emergence (%)	Maturity (weeks)	Dormancy	Chats	Small	Medium	Large	Grade No. 1	Over size >450 g	Rank Grade No.1	No. per plant	Av mkt weight (g)	SG	ACD	Sloughing	Mash	Fry#	Flesh faults† (%)	type
Suitable or ?able		Selection Criteria																		
		>41.9							> 1.064			< 1.92		<3		<8				
<b>04-195-4</b> (c&w)ft pk ey	24	98	15.0	22	13.7	21.3	30.6	0.0	51.9	0.0	14	14.0	119	1.086	1.5	2.3	3.0	3.0	10	v
04-195-10 (faint pk ey)	30	100	15.0	11	20.6	26.5	12.9	0.0	39.4	0.0	23	19.9	98	1.085	2.0	2.0	1.5	3.5	10	
04-196-1 (purple)	24	98	17.0	12	4.9	14.1	46.5	0.3	60.9	0.0	8	9.7	140	1.084	2.3	2.0	3.5	4.0	0	
<b>04-196-2</b> (purple)	24	100	15.0	15	7.7	20.4	41.5	0.4	62.3	0.0	6	12.9	122	1.084	1.5	2.0	3.5	3.0	0	
<b>04-197-5</b> (purple)	24	97	15.0	14	2.6	10.3	38.8	0.3	49.4	0.5	15	7.7	143	1.070	3.5	2.5	2.5	3.3	0	
<b>04-197-8</b> (crimson)	24	47	15.0	10	1.1	5.9	36.2	3.6	45.7	3.1	18	12.3	177	1.064	1.5	1.5	4.0	3.5	20	
Significance+		skew	skew	skew	***	***	***	skew	***	skew		***	***	***	***	***	***	***	***	*
LSD P = 0.05					3.7	7.1	16.3		13.7			2.5	27		0.9	0.8	1.0	1.6		
LSD P = 0.01																				

\* Tuber characteristics: **bold** typeface = suitable, plain type = questionable, *italic* = unsuitable. Skin colour shown if not white or cream.

@ 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.

† Significantly different internal disorders to either Nadine or Atlantic; f = fleck, s = stem end rot, v = vascular stain, h = hollows, o = other.

+ "skew" indicates data did not fulfil assumptions of analysis of variance.



**Table 5.5.5.2. Yield and quality of crisp processing entries in a November 2007 planted replicated screening at Manjimup Horticultural Research Institute, WA. 2 replications used.**

Planted 13 November 2007, harvested 18 March 2008		Harvest soil temp: 19°C			Soil type: sandy loam			Elevation: 260 m			Row spacing: 75 cm									
Entry	Spac	Yield (t/ha)			Tuber			Quality												
& tuber* characteristics	ing (cm)	Emerg	Mat-	Dorm	Chats	Small	Med-	Large	Grade	Over	Rank	No.	Av	SG	ACD	Sloug-	Mash	Fry#	Flesh	
		-ence (%)	urity (weeks)	-ancy	0-70 g	70-120 g	120-350 g	350-450 g	70-450 g	No. 1	size >450 g	Grade No.1	per plant	mkt weight (g)					color	(%)
Selection Criteria																				
>45.65										>1.085					<3.9					
<b>Atlantic (crisp)</b>	15	96	15.0	13	8.0	19.3	39.0	1.1	59.4	0.0	1	8.9	126	1.091	1.8	1.8	2.5	2.3	30	h
<b>Bliss (crisp)</b>	20	100	16.0	14	10.3	19.0	29.2	0.0	48.2	0.0	5	10.5	116	1.101	2.3	3.3	2.8	2.8	20	v
<b>04-131-5 (crisp)</b>	30	98	15.0	14	13.6	22.9	21.5	0.0	44.4	0.0	8	17.1	110	1.081	2.8	1.5	2.0	2.8	0	
<b>04-172-24 (crisp)</b>	24	98	15.0	14	11.4	20.1	35.9	0.0	55.9	0.0	2	13.4	125	1.083	2.3	1.5	2.5	2.5	10	f
04-175-4 (crisp)	24	100	15.0	15	24.0	26.8	20.8	0.0	47.6	0.0	6	18.0	107	1.081	1.5	1.5	2.8	4.5	20	v
<b>04-176-2 (c &amp; w)</b>	30	100	15.0	10	12.9	16.9	19.0	0.0	35.9	0.0	10	16.0	107	1.089	4.0	2.8	3.3	3.3	0	
<b>04-176-7 (crisp)</b>	30	100	15.0	10	13.1	19.7	20.4	0.0	40.2	0.0	9	16.2	105	1.070	3.8	1.3	1.5	4.5	0	
<b>04-195-4 (c &amp; w)</b>	24	98	15.0	22	13.7	21.3	30.6	0.0	51.9	0.0	3	14.0	119	1.086	1.5	2.3	3.0	3.0	10	v
<b>04-202-3 (crisp)</b>	24	100	17.0	10	17.6	28.6	21.2	0.4	50.2	0.0	4	16.0	106	1.079	2.8	3.0	1.8	3.5	0	
<b>04-202-11 (crisp)</b>	24	98	16.4	11	14.1	22.7	24.5	0.0	47.2	0.0	7	14.1	110	1.067	3.0	4.3	2.5	4.3	0	
Significance		skew	skew	skew	***	***	***	skew	***	skew		***	***	***	***	***	***	***	*	
LSD P = 0.05					3.7	7.1	16.3		13.7			2.5	27	0.005	0.9	0.8	1.0	1.6		
P = 0.01									24.3					0.007						

\* Tuber characteristics: **bold** typeface = suitable, plain type = questionable, *italic* = unsuitable. Skin colour shown if not white or cream.

@ 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.

† Significantly different internal disorders to either Nadine or Atlantic; f = fleck, s = stem end rot, v = vascular stain, h = hollows, o = other

+ "skew" indicates data did not fulfil assumptions of analysis of variance.

*French fries*

The two breeding lines 04-25-8 and 04-45-1 had been selected for their French fry potential. Their performance is shown in Table 5.5.5.1. 04-45-1 did not perform well as it had significantly lower yield than Russet Burbank and high incidence of internal disorders. Its shape was also obovate (tapered stem end) which is not ideal for French fry. 04-25-8 also had obovate shape and tubers were small, just 133 g, which were significantly smaller than Russet Burbank. This breeding also does not warrant further testing.

## **5.6. “05” series of breeding lines**

### **5.6.1. Background**

In April 2007 selections of breeding lines suitable for testing in WA were made from the summer grown Selection Plots at the DPIV-PBP at Toolangi, Victoria. These plots allow selection for cooking quality, attractive appearance and, possibly, tolerance to blemish diseases (silver scurf and black dot).

### **5.6.2. Selection of “05” series of breeding lines from DPIV-PBP 2007**

For the WA export crisp market we are looking for breeding lines which have improved yield and quality compared with Atlantic. Quality improvements are needed in; shape, eye depth, specific gravity, fry colour and internal disorders.

Only 25 selections were available from the about 383 fresh selection plots and 138 small processor selection plots. Previously, before 2006, about 1,500 selection plots had been available to WA.

Selections for the crisp market are shown in Table 5.6.2.1. 18 crisp breeding lines were selected in the field from 9 crosses. When cooking quality was assessed these selections were reduced to two which had specific gravity greater than 1.090 and fry colour score of less than 7.

Selections for the fresh market are shown in Table 5.6.2.2. 27 fresh breeding lines were selected in the field from 14 crosses. When cooking performance was taken into account the selections were reduced to 22. White skinned selections with ACD less than or equal to 2 were kept. Red skinned selections had to have ACD less than or equal to 1.

The performance of these selections in WA over the 2007-08 season is described in the following section (Section 5.6.3).

**Table 5.6.2.1. Crisp selections for WA from Small Processor G2 Selection Plots harvested at DPIV-PBP in April 2007. Initial selection based on tuber characteristics and final selection based on cooking quality.**

Breeding line	Tuber chars*	Spec. gravity	Fry† colour	Boiling tests‡			WA use~	Comments	WA final selection
				Colour	ACD	Slough			
<b>Selection criteria: →</b>		> 1.090	<7						
<b>Standard variety</b>									
Atlantic 8	yes	1.094	4	2	1	2	c	Standard	yes
<b>90-2-6 (Bliss) x 93-6-3</b>									
05-171-2	yes	1.101	4	2	1	2	c		yes
05-171-3	yes	1.098	5	3	2	2	c	No flesh disorders	yes
05-171-4	yes	1.080	7	1	3	3		Low SG, dark fry	no
05-171-8	yes	1.080	5	1	1	1		Low SG	no
<b>91-1-5 x 93-6-3</b>									
05-172-4		1.090	5	2	1	2		20% hollow heart, low SG	no
<b>Dawmor x Crispa “ACD free” cross £</b>									
05-188-1	yes	1.080	5	1	1	4		“ACD free” cross 20% hollow heart, low SG	no
05-188-2	yes	1.080	5	1	1	2		Low SG	no
05-188-3	yes	1.090	4	2	1	2		Low SG, very good tuber characteristics for crisp	no
<b>Pike x Dawmor</b>									
05-202-7	yes	1.078	4	1	1	1		Very good tuber characteristics, low SG	no
05-202-8	yes	1.071	3	2	2	2		Very low SG	no
<b>Snowden x 93-6-3</b>									
05-205-1	yes	1.089	4	2	2	2		Very good tuber characteristics, low SG	no
<b>Sonic x Dawmor</b>									
05-207-3	yes	1.079	6	2	1	3		Very low SG	no
05-207-5	yes	1.068	6	2	4	2		Very low SG	no

\* Tuber characteristics at harvest at Toolangi; yes = suitable, ? = questionable, no = unsuitable.

† 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.

£ACD free cross = crosses where most ACD tests at Toolangi assessed as “1” with very few scoring “2”.

**Table 5.6.2.1. continued. Crisp selections for WA from Small Processor G2 selection plots harvested at DPIV-PBP in April 2007. Initial selection based on tuber characteristics and final selection based on cooking quality.**

Breeding line	Tuber chars*	Spec. gravity	Fry† colour	Boiling tests‡			WA use~	Comments	WA final selection
				Colour	ACD	Slough			
<b>Selection criteria: →</b>									
		> 1.090	<7						
<b>Standard variety</b>									
Atlantic 8	yes	1.094	4	2	1	2	c	Standard	yes
<b>Sonic x Wilcrisp</b>									
05-208-14	yes	1.083	5	2	1	2		Low SG	no
<b>Trent x Crispa</b>									
05-209-1	yes	1.084	4	1	4	1	c, w	Low SG for crisp, ACD too dark for ware	no
<b>Whitu x Crispa</b>									
05-211-1	yes	1.077	4	1	2	1		Very low SG	no
05-211-7	yes	1.084	7	1	2	1		Low SG, dark fry	no
05-211-15	yes	1.085	6	2	1	3		Low SG	no

\* Tuber characteristics at harvest at Toolangi; yes = suitable, ? = questionable, no = unsuitable.

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

‡ Boiling tests done at Toolangi by DPIV-PBP: 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

£ACD free cross = crosses where most ACD tests at Toolangi assessed as "1" with very few scoring "2".

**Table 5.6.2.2. Ware selections for WA from Fresh G2 selection plots harvested at DPIV-PBP in April 2007. Initial selection based on tuber characteristics and final selection based on cooking quality.**

Breeding line	Tuber chars*	Skin colour	Spec. gravity	Fry† colour	Boiling tests‡			WA use~	Comments	WA final selection
					Colour	ACD	Slough			
<b>Selection criteria: →</b>					≤2 or ≤1				white skin ACD entries ≤2, red skin ACD ≤1	
<b>Standard varieties</b>										
Desiree 5		pink	1.078	5	4	1	1			
Desiree 6		pink	1.086	7	4	1	1			
Sebago 6		white	1.076	6	2	1	1			
Ruby Lou 5		pink	1.078	5	2	3	1			
Russet B'ank 12		l. brown	1.093	5	2	1	2			
Russet B'ank 13		l. brown	1.088	7	2	2	1			
<b>90-77-4 x Fontenot</b>										
05-213-3	yes	red	1.081	5	2	2	1	w	ACD too dark for red skin	no
<b>93-37-3 x Shine</b>										
05-214-3	yes	white	1.083	6	1	1	2	w		yes
05-214-5	?	white	1.065	7	2	1	1	w		yes
05-214-9	?	white	1.071	5	1	2	2	w		yes
<b>95-97-9 x 93-37-3</b>										
05-215-3	yes	white	1.071	5	1	1	2	w		yes
05-215-12	yes	white	1.080	5	1	2	2			yes
05-215-18	yes	white	1.074	8	2	1	2		Very good tuber characteristics	yes
05-215-20	yes	white	1.073	5	1	2	2			yes
05-215-23	yes	white	1.086	5	2	2	3	w		yes
<b>96-32-19 x Shine</b>										
05-216-10	yes	white	1.072	5	1	1	2			yes

\* Tuber characteristics at harvest at Toolangi; yes = suitable, ? = questionable, no = unsuitable.

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

‡ Boiling tests done at Toolangi by DPIV-PBP: 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.

£ACD free cross = crosses where most ACD tests at Toolangi assessed as "1" with very few scoring "2".

Table 5.6.2.2. continued. Ware selections for WA from Fresh G2 selection plots harvested at DPIV-PBP in April 2007. Initial selection based on tuber characteristics and final selection based on cooking quality.

Breeding line	Tuber chars*	Skin colour	Spec. gravity	Fry† colour	Boiling tests‡			WA use~	Comments	WA final selection
					Colour	ACD	Slough			
<b>Selection criteria: →</b>					≤2 or ≤1				white skin ACD entries ≤2, red skin ACD ≤1	
<b>Standard varieties</b>										
Desiree 5		pink	1.078	5	4	1	1			
Desiree 6		pink	1.086	7	4	1	1			
Sebago 6		white	1.076	6	2	1	1			
Ruby Lou 5		pink	1.078	5	2	3	1			
Russet Burbank 12		l. brown	1.093	5	2	1	2			
Russet Burbank 13		l. brown	1.088	7	2	2	1			
<b>Campbell 14 x 89-42-6 (Warren Wonder)</b>										
05-217-2	yes	white	1.085	6	3	2	2			yes
05-217-3	yes	white	1.097	5	4	1	1			yes
<b>Desiree x Fontenot</b>										
05-222-1	yes	red	1.093	7	4	2	1		ACD too dark for red skin	no
<b>Durango Red x Ruby Lou</b>										
05-223-6	yes	red	1.077	3	3	2	1		ACD too dark for red skin, space out	no
<b>Fontenot x Ruby Lou</b>										
05-224-6	?	red	1.089	6	2	3	1		ACD too dark for red skin	no
<b>Granola x Wilwash</b>										
05-227-4	yes	white	1.063	5	2	2	1		No blemish seen in field	yes
05-227-6	yes	white	1.073	5	3	2	1		No blemish seen in field	yes
<b>Hudson x Toolangi Delight</b>										
05-228-7	yes	white	1.082	3	1	2	1		No blemish seen in field	yes

\* Tuber characteristics at harvest at Toolangi; yes = suitable, ? = questionable, no = unsuitable.

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

‡ Boiling tests done at Toolangi by DPIV-PBP: 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.

£ACD free cross = crosses where most ACD tests at Toolangi assessed as "1" with very few scoring "2".

**Table 5.6.2.2. continued. Ware selections for WA from Fresh G2 selection plots harvested at DPIV-PBP in April 2007. Initial selection based on tuber characteristics and final selection based on cooking quality.**

Breeding line	Tuber chars*	Skin colour	Spec. gravity	Fry† colour	Boiling tests‡			WA use~	Comments	WA final selection
					Colour	ACD	Slough			
<b>Selection criteria: →</b>					≤2 or ≤1				white skin ACD entries ≤2, red skin ACD ≤1	
<b>Standard varieties</b>										
Desiree 5		pink	1.078	5	4	1	1			
Desiree 6		pink	1.086	7	4	1	1			
Sebago 6		white	1.076	6	2	1	1			
Ruby Lou 5		pink	1.078	5	2	3	1		ACD too dark	
Russet Burbank 12		l. brown	1.093	5	2	1	2			
Russet Burbank 13		l. brown	1.088	7	2	2	1			
<b>Mondial x Wilwash</b>										
05-233-5	yes	white (pu)	1.063	5	2	1	1			yes
05-233-7	yes	white	1.069	7	4	1	1			yes
05-233-11	?	white	1.066	5	4	1	1			yes
05-233-12	yes	l. yellow	1.061	6	3	2	1			yes
<b>Nadine x 93-37-3 “ACD free” cross £</b>										
05-235-3	yes	white	1.069	9	1	2	1			yes
05-235-6	yes	white	1.070	9	1	1	1			yes
05-235-17	yes	white	1.077	9	1	2	1			yes
<b>Norland Wisc Super Red x Ruby Lou</b>										
05-237-1	yes	red	1.078	6	2	2	1		ACD too dark for red skin	no
<b>Shine x 93-37-3</b>										
05-246-18	yes	white	1.071	5	1	1	2			yes

\* Tuber characteristics at harvest at Toolangi; yes = suitable, ? = questionable, no = unsuitable.

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

‡ Boiling tests done at Toolangi by DPIV-PBP: 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.

£ ACD free cross = crosses where most ACD tests at Toolangi assessed as “1” with very few scoring “2”.



**5.6.3. November 2007 planted unreplicated screening at Manjimup Horticultural Research Institute.**

**Aims**

- 1 To select entries suitable for the fresh market in a November planting at Manjimup Horticultural Research Institute. The entries comprise 24 “05” series of DPIV-PBP breeding lines plus 7 standard varieties; Atlantic, Bliss, Coliban, Delaware, Desiree, Nadine and Ruby Lou.
- 2 To provide high quality seed for further tests.

**Results**

It is a WA quarantine requirement that tubers of breeding lines from the DPIV-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 DPIV-PBP at Toolangi in 2007 were tested by AGWEST Plant Laboratories (laboratory samples 08/1170) 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 screening grew well despite the extreme Christmas period heat which damaged some plants.

22 entries were classified as fresh market types (Table 5.6.3.1). Selections had suitable or questionable tuber characteristics with specific gravity greater than 1.055. Selections are shown in bold typeface in Table 5.6.3.1. 18 selections were made for further testing in next season’s replicated screening.

**Table 5.6.3.1. Tuber characteristics, yield and quality of ware potato breeding lines in a November 2007 planted unreplicated screening at Manjimup Horticultural Research Institute. Selections shown in bold.**

Entry	TC*	SG	Yield >80 g (t/ha)	Selection criteria		Final select -tion
				Crisp# colour	Field notes & reason for selection/rejection	
				? or yes > 1.055		
Coliban	no	1.072	28	5	Unsuitable tuber chars.	no
Delaware	no	1.085	64		Unsuitable tuber chars.	no
Desiree	no	1.078	54	5	Unsuitable tuber chars.	no
<b>Nadine</b>	yes	1.060	51			<b>yes</b>
<b>Ruby Lou</b>	yes	1.073	40			<b>yes</b>
<b>05-214-3</b>	yes	1.058	24	6	Space out to 30 cm, good shape for crisp	<b>yes</b>
<b>05-214-5</b>	yes	1.061	54	7	Space out to 30 cm	<b>yes</b>
<b>05-214-9</b>	yes	1.066	27	5	Space out, good shape for crisp	<b>yes</b>
<b>05-215-3</b>	?	1.059	51	5	Many smalls	<b>yes</b>
<b>05-215-12</b>	?	1.071	56	5	Space out to 30 cm, good shape for crisp	<b>yes</b>
<b>05-215-18</b>	yes	1.056	53	8	Blemish free	<b>yes</b>
<b>05-215-20</b>	yes	1.058	51	5	Good shape for crisp	<b>yes</b>
<b>05-215-23</b>	yes	1.069	48	5		<b>yes</b>
<b>05-216-10</b>	yes	1.065	76	5		<b>yes</b>
<b>05-217-2</b>	yes	1.081	67	6	Shape a little uneven	<b>yes</b>
<b>05-217-3</b>	yes	1.100	71	5		<b>yes</b>
05-227-4	no	1.062	44		Unsuitable tuber chars.	no
05-227-6	no	1.074	40	5	Unsuitable tuber chars.	no
<b>05-228-7</b>	?	1.082	51	3	Deep eyes	<b>yes</b>
<b>05-233-5</b>	?	1.058	44	5	Growth cracks	<b>yes</b>
<b>05-233-7</b>	yes	1.063	45	7		<b>yes</b>
<b>05-233-11</b>	?	1.059	59	5	Too flat?	<b>yes</b>
05-233-12	no	1.059	99	6	Unsuitable tc, low SG.	no
<b>05-235-3</b>	?	1.064	38	9	Space out to 30 cm, crisp shape	<b>yes</b>
05-235-6	yes	1.052	67	9	Low SG	no
<b>05-235-17</b>	yes	1.062	109	9	High yield	<b>yes</b>
<b>05-246-18</b>	yes	1.061	51			<b>yes</b>

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

# Crisp colour; scale 1 - 10 (light to dark), <7 acceptable for crisps. Tests done at Toolangi by DPIV-PBP April 2007.

Eight entries were classified as crisp types (Table 5.6.3.2). Selections had suitable or questionable tuber characteristics with specific gravity greater than 1.080. Selections are shown in bold typeface in Table 5.6.3.2. Two selections were made for further testing in next season's replicated screening. The main reason for rejection of the other breeding lines was low specific gravity.

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

**Table 5.6.3.2. Tuber characteristics, yield and quality of crisp potato breeding lines in a November 2007 planted unreplicated screening at Manjimup Horticultural Research Institute. Selections shown in bold.**

Entry	TC*	SG	Yield >80 g (t/ha)	Crisp# colour	Field notes & reason for selection/rejection	Final select -tion
Selection criteria						
? or yes > 1.080						
<b>Atlantic</b>	<b>yes</b>	<b>1.086</b>	<b>76</b>	<b>7</b>		<b>yes</b>
<b>Bliss (90-2-6)</b>	<b>yes</b>	<b>1.101</b>	<b>55</b>	<b>*</b>		<b>yes</b>
<b>05-171-2</b>	<b>?</b>	<b>1.096</b>	<b>31</b>	<b>6</b>	<b>Too small?</b>	<b>yes</b>
<b>05-171-3</b>	<b>yes</b>	<b>1.097</b>	<b>67</b>	<b>5</b>		<b>yes</b>
05-214-3	yes	1.058	24	6	Low SG	no
05-214-9	yes	1.066	27	5	Low SG	no
05-215-12	?	1.071	56	5	Low SG	no
05-215-20	yes	1.058	51	5	Low SG	no
05-235-3	?	1.064	38	9	Low SG	no
05-246-18	yes	1.061	51	*	Low SG	no

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

# Crisp colour; scale 1 - 10 (light to dark), <7 acceptable for crisps. Tests done at Toolangi by DPIV-PBP April 2007.

## **5.7. Assessing efficacy of blemish disease control chemical treatments to determine requirement for selection for blemish disease tolerance**

### **Background**

Blemish diseases of potatoes were once considered only secondary pathogens that received little consideration from farmers and industry. Recently however, the importance of these blemish diseases has increased as a greater understanding of their lifecycle and the negative impact on both tuber quality and yields has been discovered. Greater consumer demands for high quality potatoes with minimal skin damage and attractive cosmetic appearance has also lead to more emphasis being placed on the management of these diseases.

Two of the most commonly occurring blemish diseases are silver scurf (*Helminthosporium solani*) and black dot (*Colletotrichum coccodes*). Currently there are no registered chemical applications to simultaneously control both of these organisms in Australia. Two commercially available products Amistar 250 SC<sup>®</sup> and Maxim 100 FS<sup>®</sup> are registered for suppression of silver scurf on potatoes, while Amistar 250 SC<sup>®</sup> has recently been shown to have some beneficial activity against black dot in South Australia (Harding *et al.* 2005). The efficacy of these products under WA conditions and soil types is unknown. If effective chemical control options are available to WA farmers then varietal tolerance to these diseases does not have to be a major selection criterion for the variety evaluation program. If appropriate chemical controls are available, then disease tolerance selection pressure on new varieties can be reduced to increase the chance of finding varieties with improvements in other quality characteristics such as tuber uniformity, after-cooking-darkening and taste.

### **Aim**

To determine whether tolerance to blemish disease should be a selection criterion in the WA fresh market potato variety evaluation program or whether chemical control is effective enough to allow selection of susceptible varieties.

### **Method**

This trial was planted at a commercial seed potato property at Rosa Brook in the Margaret River region of South West Western Australia. Seed tubers were taken from a seed crop grown in 2005-06.

The treatments were laid out in a split plot design with the main treatment being soil fumigation with Metham Sodium<sup>®</sup>. Variety and fungicide seed tuber treatments were the sub treatments

Seed tubers treatments were one of the following:

1. Amistar 250 SC<sup>®</sup> (azoxystrobin) 9 mL per 100 m row sprayed on setts in furrow. Registered for silver scurf control in potatoes.
2. Maxim100FS<sup>®</sup> (fludioxinil) 1 mL per 4 kg of seed sprayed on setts prior to planting. Registered for silver scurf control in potatoes.
3. Control (no fungicide application).

The two varieties chosen were Auski (susceptible) and Billabong (tolerant). A 200 tuber sample of the seed used for each variety was assessed for incidence and severity of black dot.

The tubers were planted on the 26 October 2006; plots were double rows 6.6m long including a 0.6m buffer zone. Rows were 75 cm wide. There were 4 replicates per treatment. The trial was fertilised and irrigated as per the commercial growers own crop and left to mature naturally.

Two harvest times were used to examine the effect of ground storage on blemish disease development. A single row of the two row plots was harvested on each occasion using a single row mechanical harvester. The first harvest occurred on the 9 March 2007 and the second harvest four weeks later on the 4 April 2007.

Yield was determined by grading all tubers from each plot into standard size grades.

Disease incidence and severity were determined from a sample of 100 tubers from each harvest time from each plot. Incidence was the number of tubers with the presence of black dot. Severity was scored on the following 0-4 scale;

- 0 No symptoms
- 1  $< \frac{1}{4}$  tuber surface infection
- 2  $\frac{1}{4}$  to  $< \frac{1}{2}$  tuber surface infection
- 3  $\frac{1}{2}$  to  $\frac{3}{4}$  tuber surface infection
- 4  $> \frac{3}{4}$  tuber surface infection

Soil cores were taken from all plots besides the fludioxinil treated plots and sent to Robin Harding, South Australian Research and Development Institute (SARDI), for analysis as part of research into the effect of metham sodium and azoxystrobin on the soil population of the black dot fungus. The soil cores were taken on the 8 March 2007 using a 15 cm soil corer. Ten cores were taken per plot and pooled into a plastic bag. In South Australia, the soil was dried and the DNA of a variety of soil borne fungi per gram of soil was determined through DNA sequencing.

Effects on severity and incidence of black dot on the tubers and marketable yield were analysed via analysis of variance.

## **Results**

Assessment of seed tuber infection showed that Billabong had an incidence of 39% and average severity of 0.57 while Auski had an incidence of 88% and severity of 1.8.

There were no visual negative effects on the crop from any of the treatments used. The weather during the crop was typical of a summer in South West of WA, with extended dry periods and hot daytime temperatures. The majority of the treatments reached 50% emergence on the 14 November 2006 with emergence of some treatments delayed until the 21 November 2006. Plant numbers and stem counts were consistent between treatments for both varieties with Auski having three stems per plant and Billabong only two.

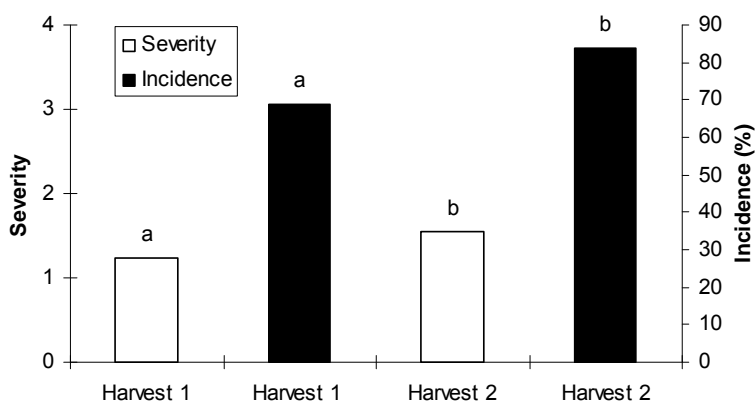
There was little difference in maturity between treatments. Auski matured 15.4 weeks after planting and Billabong matured at 15.3 weeks. The metham sodium treated plots matured at 15.5 weeks while plots not treated with metham sodium matured at 15.2 weeks. Plots not

treated with fungicide matured at 14.9 weeks while fludioxinil treated plots matured at 15.2 weeks and azoxystrobin treated plots matured at 15.9 weeks.

Due to the overwhelming presence of black dot and the similarities between that and silver scurf, the severity and incidence of silver scurf was not assessed.

Effect of harvest time on disease incidence and severity

There were significant differences in the incidence and severity of black dot between both harvest times with harvest 1 having significantly less incidence of black dot on both varieties Auski and Billabong (Figure 5.7.1). The severity of black dot infection in harvest 1 was also significantly lower on both varieties than harvest 2 (Figure 5.7.1).



**Figure 5.7.1. Incidence and severity differences between the two harvest times. Treatments with the same letter are not significantly different from one another.**

Effect of variety on disease incidence and severity

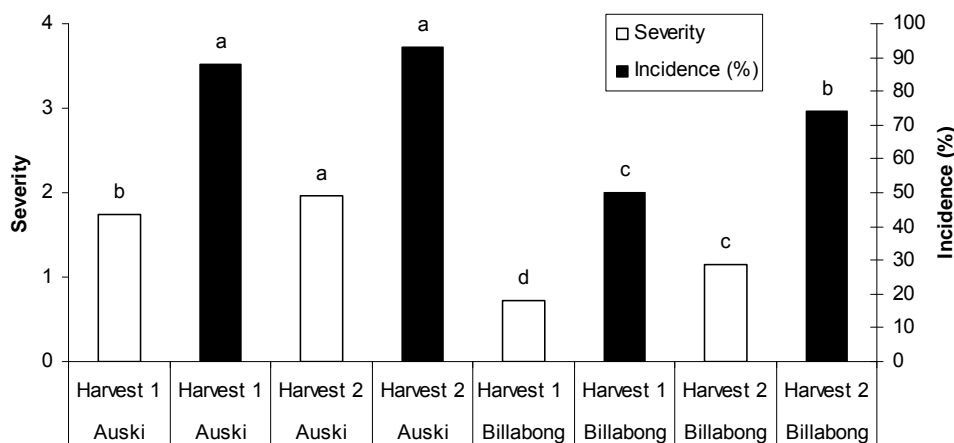
There were significant differences in the Grade No. 1 yield and severity and incidence of black dot between the two varieties used in the trial. Auski, the susceptible variety, had significantly higher incidence and severity of black dot but also had a significantly higher yield than the tolerant variety Billabong (Table 5.7.1).

**Table 5.7.1. Black dot incidence, severity and yield difference between varieties from the combined harvests.**

Variety	Black dot severity	Black dot incidence (%)	Grade No. 1 yield (t/ha)
Auski	1.849	90	63.52
Billabong	0.938	62	48.04
Significance	***	***	***
LSD (P = 0.05)	0.110	0.04	2.57

Effect of variety and harvest time on disease incidence and severity

Black dot severity was significantly the highest with harvest 2 and Auski (Figure 5.7.2). The incidence levels of black dot for Auski at both harvest times were not significantly different (Figure 2). Billabong tubers from the first harvest had a significantly lower incidence and severity of black dot than all other combinations (Figure 5.7.2).



**Figure 5.7.2. Severity and incidence differences between the combination of variety and harvest times. Treatments with the same letter are not significantly different from one another.**

Effect of fungicides on disease incidence and severity

In furrow applications of azoxystrobin had a significant reduction in the severity and incidence of black dot in comparison to the control and use of fludioxinil seed treatments for both varieties (Table 5.7.2). The use of azoxystrobin also significantly increased the marketable yield of the tubers in comparison to fludioxinil and the control (Table 5.7.2). Fludioxinil seed treatment did not have any significant effect over the control on the severity and incidence of black dot and the marketable yield (Table 5.7.2).

**Table 5.7.2. Incidence, severity and yield differences between the different fungicide treatments.**

Fungicide	Severity	Incidence (%)	Grade No. 1 Yield (t/ha)
None	1.561	83	53.06
fludioxinil	1.556	82	53.56
azoxystrobin	1.062	63	60.72
Significance	***	***	***
LSD 5% (P=0.001)	0.135	0.05	3.15

Effect of metham sodium on disease incidence and severity

The use of metham sodium as a soil fumigant had no significant effect in reducing the incidence and severity of black dot (Table 5.7.3). The use of metham sodium had a slight increase in marketable yield over no metham sodium use but this was not significant (Table 5.7.3).

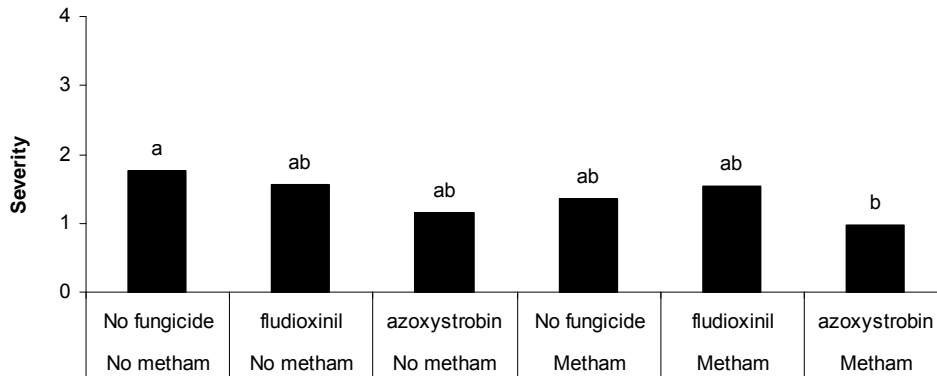
**Table 5.7.3: Black dot incidence, severity and yield differences between the use of metham sodium for both harvests.**

Metham treatment	Severity	Incidence (%)	Grade No. 1 Yield (t/ha)
Metham sodium	1.295a	71a	59.33
No metham sodium	1.492a	81a	52.23
Significance	ns	0.182	ns
LSD (P=0.05)	0.8880	0.210	17.90

Effect of fungicides with metham sodium on disease incidence and severity

The combination of metham sodium and fungicide treatment was significant at the 95% level for severity ( $p=0.032$ ). The application of azoxystrobin and metham sodium produced the lowest severity score for both varieties and this was the only treatment that was significantly lower than the control (Figure 5.7.3). However, the azoxystrobin and metham sodium treatment did not significantly reduce the severity of black dot over the fludioxinil treatments, with and without metham sodium, and the azoxystrobin treatment without metham sodium and the metham sodium alone (Figure 5.7.3).





**Figure 5.7.3. The use of metham sodium in combination with fungicides for both harvests (LSD = 0.7695). Treatments with the same letters are not significantly different from one another.**

#### Soil Analysis

Soil analysis indicated that the black dot fungus was present in the soil of all plots with the highest levels of DNA being recorded in the treatment 12 plot of replicate 4. There was no significant difference in the black dot soil DNA between all the plots containing metham sodium or no metham sodium, azoxystrobin or control and between varieties ( $P = 0.191$ ).

#### **Discussion**

##### Fungicide treatments

The results from this study indicate that the use of azoxystrobin in furrow significantly reduces the incidence and severity of black dot in comparison with fludioxinil seed treatment and no fungicide treatment. This reduction in severity and incidence occurred for both the susceptible variety Auski and the tolerant variety Billabong. The use of fludioxinil as a seed treatment did not significantly reduce the severity and incidence of the black dot over the control.

Similar results were found in South Australia where the use of azoxystrobin in furrow on the variety Coliban was found to be more effective in controlling black dot infections than seed treatments of fludioxinil (Harding *et al.* 2005). In contrast, another experiment in the same study indicated that individual seed treatments of azoxystrobin and fludioxinil were more effective in reducing both the incidence and severity of black dot than in furrow treatments of the same products (Harding *et al.* 2005). It was mentioned however that it was possible that the application rates of the drenches were too low.

The use of azoxystrobin could benefit farmers due to significant increases in the marketable yield. The 7 t/ha increase in yield of Grade No 1 tubers attributed to Amistar<sup>®</sup> in this trial would have increased income to approximately \$3,500/ha assuming a potato price of \$500/tonne. The rate of fungicide applied was 1.2 L/ha at a cost of \$211/ha (5 L = \$880).

Amistar<sup>®</sup> as an in-furrow treatment for black dot is therefore cost beneficial for potato farmers.

#### Metham sodium treatment

The use of metham sodium alone did not significantly reduce the severity and incidence of black dot infections, but in combination with fungicides there was a slight significant reduction. The layout of the experiment meant that there were only two main treatment blocks, with and without metham sodium, and the lack of replication was probably an important contributor to the non-significance effect. The use of metham sodium and azoxystrobin produced the tubers with the lowest severity of black dot and this was the only treatment that was significantly different to the control. However the use of metham sodium and azoxystrobin was not significantly different to the other treatments in the trial.

Metham sodium did not have any significant impact on the yield of the potatoes. Harding *et al.* (2005) also found that when seed tubers that were 100% infected with black dot were planted, metham sodium was ineffective in controlling the disease and decreased yields resulted. Both seed varieties used in this experiment were infected with black dot, with incident rates of 39% and 88% for Billabong and Auski, respectively. Harding *et al.* (2005) found that when healthy (uninfected) seed tubers were planted, metham sodium significantly increased yield but not disease control. As the use of metham sodium had no effect on the disease control of healthy tubers it appears that its ability to control the black dot pathogen is limited and possible yield gains may result from suppression of other soil borne pathogens only.

#### Time of Harvest

The overall severity and incidence of black dot significantly increased between the two harvests. This is not surprising as the tubers were left in the soil for four weeks longer thus providing the black dot fungus more time to infect and for lesions to spread. Also the effectiveness of the active ingredient of the fungicides would have reduced as harvest was delayed.

#### Soil Analysis

The soil analysis indicates that azoxystrobin and metham sodium had little effect on the soil population of the black dot fungus. It is difficult to form conclusions regarding this soil data, more than one sampling event needs to be performed during the crop to provide useful data for comparison. Furthermore as the sampling did not include the fludioxinil treatment true comparisons between fungicides cannot be made. The soil data will however provide useful information for researchers in South Australia for their studies on the black dot fungus and the effects azoxystrobin and metham sodium have on it.

#### Variety

Auski produced significantly higher yields than the Billabong variety in both harvests. This was expected as Auski has previously produced greater yields than Billabong (Dawson & Mortimore 2004a). Auski produced these yields despite having significantly higher incidence and severity of black dot infection at both harvest times. The difference in susceptibility and incidence of black dot between the two varieties is a result of physiological differences between the varieties. The precise mechanism of varietal susceptibility to black dot remains unknown.

**Conclusion**

This study has shown that the application of Amistar<sup>®</sup> in furrow can significantly reduce the severity and incidence of black dot infections of potatoes. The use of Amistar<sup>®</sup> also significantly increased the marketable yield of the potatoes and is therefore a cost effective product for commercial potato farmers at its current price. However, although Amistar<sup>®</sup> was effective in reducing the incidence and severity of black dot infections, the susceptible variety used in the trial, Auski, still had levels of black dot incidence and severity that would be considered too high by wash packers and consumers. It is therefore necessary for the variety evaluation program to continue to select for varieties that are tolerant to blemish diseases.

### **5.8. Potential future breeding lines for WA**

A recommendation from the previous WA potato variety evaluation project (Dawson & Mortimore 2006) was that “crosses should be planned with the breeder that will provide breeding lines with the characteristics required by the WA potato industry”. To assist with this planning previous WA experimental data was searched to help identify the best potential parents for future crosses.

To reiterate, the selection criteria presented in Section 4.4 the WA fresh potato industry is seeking new varieties with the visual characteristics of Nadine and versatile culinary attributes with no after-cooking-darkening. Resistance to blemish diseases (silver scurf and black dot) is an important part of having good appearance.

Breeding lines which showed good appearance and low ACD scores were found from summer grown experiments planted at Margaret River and Manjimup/Pemberton. These locations were chosen as the soils are prone to producing high ACD scores and the planting time produces high levels of tuber blemish disease. Data from 21 experiments completed in the years 1992 to 2003 were examined (Dawson *et al.* 1998, Dawson & Mortimore 2000, 2004a, 2004b, 2005 & 2006).

The parents of these breeding lines were then identified. The parents that were associated with the characteristics required by the WA industry are listed in Table 5.8. They are ranked according to the number of times that they were found to be associated with the desired characteristics. The list is offered for consideration by the breeding team when deciding which parents might be suitable for breeding material for summer fresh market production for WA.

**Table 5.8. Parents of crosses in WA at Marg River and Manjimup which had either low after-cooking-darkening (ACD) score or suitable tuber characteristics (TC).**

Parent associated with either low ACD score in WA at Margaret River & Manjimup or suitable TC	Characteristic	No times identified (ACD then TC)	Total no times identified	Notes
Wilwash (80-98-14)	ACD & TC	5 & 6	11	Very susceptible to blemishes (silver scurf, black dot)
Denali	ACD & TC	3 & 6	9	
Knox (Wilcrisp 79-5-2)	ACD & TC	4 & 4	8	
Mondial	ACD & TC	3 & 3	6	Gave blemish tolerance to progeny e.g. 95-37-12 (Billabong)? Other parent was 85-30-12. But 95-37-12 had bad ACD!
85-30-12	ACD & TC	3 & 3	6	Gave tolerance to blemish to progeny 95-37-12 (Billabong)? Other parent was Mondial. But 95-37-12 had bad ACD!
Lenape	ACD & TC	3 & 2	5	Alkaloids?
Centennial Russet	ACD & TC	3 & 2	5	
Maris Piper	ACD & TC	3 & 1	4	
Lindsay	ACD & TC	3 & 1	4	
Coliban	ACD & TC	1 & 3	4	
Nooksack	ACD	3	3	Nooksack is known for greying in F fry plants. Therefore other parent might be suitable?
89-12-1 (Eureka/Riverina Russet)	ACD & TC	1 & 2	3	gets ACD so other parent could be good?
80-102-7	ACD & TC	2 & 1	3	
66-11-2	ACD	3	3	
Yukon Gold	ACD & TC	1 & 1	2	
Winlock (78-26-7)	ACD & TC	1 & 1	2	
Toolangi Delight	ACD	2	2	
Snow Gem (80-98-16)	ACD & TC	1 & 1	2	
Norchip	ACD & TC	1 & 1	2	
ND258/1	ACD	2	2	
Crystal	ACD	2	2	
Catani (86-34-4)	ACD & TC	1 & 1	2	Gave tolerance to blemish to progeny 92-123-7? Other parent was Wilwash

**Table 5.7. continued. Parents of crosses in WA at Marg River and Manjimup which had either low after-cooking-darkening (ACD) score or suitable tuber characteristics (TC).**

<b>Parent associated with either low ACD score in WA at Margaret River &amp; Manjimup or suitable TC</b>	<b>Characteristic</b>	<b>No times identified (ACD then TC)</b>	<b>Total no times identified</b>	<b>Notes</b>
Atlantic	TC	2	2	
Agria	ACD & TC	1 & 1	2	
A8670-6	ACD	2	2	
Rosa	ACD	1	1	
Lemhi Russet	ACD	1	1	
Kenzy	TC	1	1	
Kennebec	ACD	1	1	
Exodus	TC	1	1	
Chipbelle	TC	1	1	
Campbell 14	ACD	1	1	
Belchip	ACD	1	1	
92-37-1 (Fergi Fry)	ACD	1	1	
91-106-1 (Sonic)	ACD	1	1	
89-30-8	ACD	1	1	
88-102-24 (Penguin)	TC	1	1	
86-64-4	ACD	1	1	
86-31-3	ACD	1	1	
86-19-1	ACD	1	1	
86-12-17	ACD	1	1	
85-11-9 (Wilstore)	TC	1	1	
80-5-10	ACD	1	1	
80-12-3	TC	1	1	
78-11-4	ACD	1	1	

## **6. Discussion**

### **6.1. Introduction**

The potato variety evaluation testing procedure used in Western Australia takes five years from the initial selection of breeding lines at the DPI-PBP to the harvest of the demonstration phase. Further time is then needed for more advanced testing following the demonstrations. A new cycle of evaluation activities begins every year resulting in all of the testing phases being in progress concurrently. Therefore, although this report presents results from a mere two years' activities, outcomes of all activities can be reported. We are able to report on the crowning achievement of the launch of a new variety down to the results of the first, unreplicated, small scale screening experiment.

### **6.2 Advanced breeding lines**

#### **6.2.1 White Star Perth Royal Show Launch.**

White Star was first tested in WA in 1999 (Dawson & Mortimore 2004a) and a summary of the early experimental results can be found in Mortimore et al. (2005). The subsequent commercial test results were described by Dawson & Mortimore (2006). They found that for May plantings White Star produced oblong tubers with shallow eyes and heel, skin texture is smooth and skin and flesh colour is cream. White Star's benefits over Delaware and Nadine in this cropping period were: better appearance than Delaware, better yield than Nadine, larger tubers than Delaware and Nadine, better fry quality than Delaware and Nadine plus White Star also had good tolerance to powdery scab. The disadvantage compared with Nadine was that White Star's resistance to PCN is not known.

A Benefit Cost Analysis by Mattingley (Islam 2007, pp 75-81) showed White Star provided an increased gross margin compared with Nadine due to improved yield and price and reduced seed costs. This BCA showed a NPV of \$1.9 million with a benefit cost ratio of 12.6.

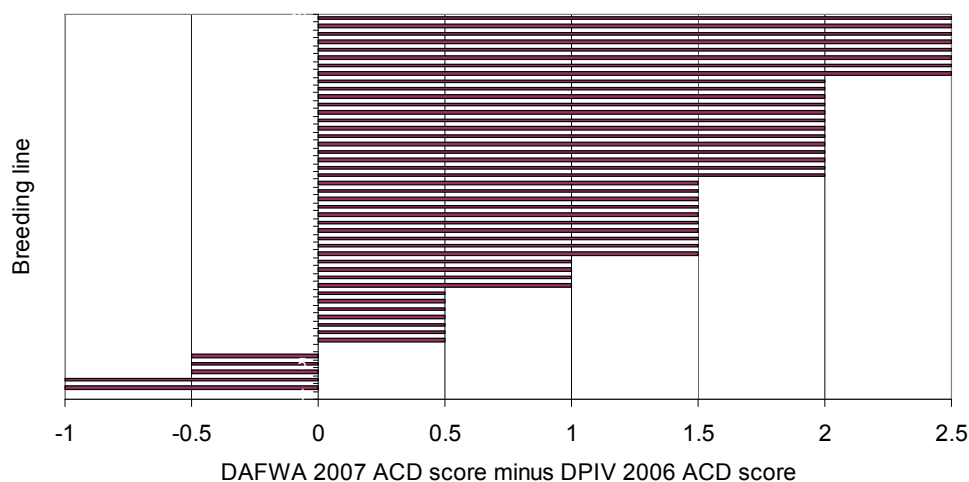
Consumers also benefit from White Star. An independent culinary evaluation commissioned by WPL showed that White Star had similar taste, texture and flesh colour to Royal Blue (Ray Wilson, personal communication). This is a highly propitious finding as Royal Blue is considered to be the best tasting potato available in Western Australia. Samples of White Star were given to chefs who commented how they loved White Star and could easily use them in restaurants (Ray Wilson, personal communication). It means that WA consumers now have a mainstream variety with similar culinary quality to the Royal Blue.

The culmination of the development of White Star was its launch at the Perth Royal Show in September 2007 by the Honourable Mr Kim Chance, Minister for Agriculture and Food in Western Australia (Australian Labor Party 2007). The launch was organised at this time to coincide with the first season of commercial production when sufficient retail quantities were available to ensure widespread availability. Extensive publicity occurred with the launch of White Star and details are discussed under Technology Transfer (Section 7).

### 6.2.2 Billabong withdrawal

Whereas independent culinary evaluation commissioned by WPL showed White Star to be a superior potato in both culinary versatility and flavour, a similar evaluation of Billabong recommended that this variety was not suitable for the fresh market in WA (Ray Wilson, personal communication). This evaluation showed that after-cooking-darkening and poor mashing quality made the variety unsuitable for commercial production, consequently testing of the variety ended in 2007.

This failure of Billabong to meet acceptable ACD score means that selection criteria for ACD in WA need to be tightened. A comparison of ACD scores from the same breeding lines from Victoria and WA showed that ACD was generally worse in WA (Table 5.5.2.2.). These data are presented below in Figure 6.2.2 which makes the differences more apparent. All positive bars indicate breeding lines that had darker ACD in WA. 43 of the 48 entries were in this category and many had considerable darker ACD. The WA potato would like new varieties with no ACD. This mean that breeding lines destined for areas like Manjimup and Pemberton, which are prone to ACD, must have a very low ACD score from Victorian tests. ACD levels are site and variety specific (Burton 1989). Increased soil chloride, iron and ammonia levels lead to increased ACD while variety specific levels of chlorogenic acid within the tuber can lead to reduced ACD.



**Figure 6.2.2. Differences in after-cooking-darkening scores of 48 breeding lines and standard varieties tested in both Victoria and WA. Victorian tests were done in 2006 on potatoes grown at Toolangi while the WA tests were done in 2007 on potatoes grown at Margaret River. The Victorian score was subtracted from the WA score. Positive values indicate darker ACD in WA and negative scores indicate lighter ACD in Victoria. Data from Table 5.5.2.2.**



## 6.3 Demonstrations

### 6.3.1 November planted French fry demonstration of “97” and “98” series of breeding lines 2006-07

The demonstration has confirmed 98-107-13 has high yield and good processing quality. The standard variety, Ranger Russet produced 48.9 t/ha of Fry Grade tubers (>100 g) while 98-107-13 produced 53.6 t/ha (Table 5.2.5). A summary of all previous WA tests is given in Table 6.3.1. In two previous tests against Russet Burbank 98-107-13 had 162 per cent higher yield. While this may be due to the late maturing Russet Burbank not reaching full maturity, a common fault in variety trials, it indicates that 98-107-13 is worth testing further. Quality of 98-107-13 is also promising as the demonstration showed it had the highest specific gravity of 1.083 while Ranger Russet has specific gravity of 1.078. 98-107-13 merits further testing to determine whether it has benefits for commercial production.

**Table 6.3.1. Summary of summer planted experiments of 97-107-13. Trial 01BU2 & 02AL37MA from Dawson & Mortimore (2004a).**

Entry, tuber* characteristics & spacing in row (cm)	Yield (t/ha)						Tuber No. per plant	Quality			
	Chats	Small	Med- ium	Large	Over size	Fry Grade		SG	Fry# color	Flesh faults	
	0-70 g	70- 120 g	120- 350 g	350- 450 g	>450 g	>120 g					
Trial 01BU2. November 2001 planted replicated screening at Margaret River. 98-107-13 was selected.											
Russet Burbank	40	5.1	15.1	45.0	2.0	0.4	47.4	16.4	1.075	6.0	
<b>98-107-13</b>	24	1.0	4.5	66.9	17.3	10.7	88.7	8.6	1.082	4.5	
LSD 5%		skew	7.4	17.4	skew	skew	19.3	2.5	0.005	2.5	
Trial 02AL37MA. November 2002 planted district trial at Pemberton. 98-107-13 was selected.											
<b>Eureka##</b>	20	4.6	10.3	46.7	2.8	0.3	49.8	8.7	1.071	4.0	7
<b>Russet Burbank</b>	36	4.6	10.4	33.3	1.5	0.6	35.4	11.0	1.073	5.0	0
<b>98-107-13</b>	20	1.9	7.6	39.0	4.4	2.6	46.0	5.6	1.077	5.0	0
LSD 5%		ns	ns	ns	skew	skew		2.1	0.003	1.4	ns
Trial November 2006 planted demonstration at Manjimup. Monaro & 98-107-13 were selected.											
		0-100		100- 280	280- 450	>450	>100 g				
<b>MacRusset</b>	37	2.3		22.4	12.5	2.5	37.4	6.7	1.079	5	0
<b>Monaro (97-102-1)</b>	25	1.2		15.1	16.5	10.7	42.4	4.8	1.079	5	12†
<b>Ranger Russet</b>		5.1		32.5	14.2	2.2	48.9		1.078	4	0
<b>98-107-13</b>	25	1.1		26	20.2	7.4	53.6	5.6	1.083	5	0
Averages of two trials comparing 98-107-13 with Russet Burbank. (01BU2 & 02AL37MA).											
		0-70 g	70- 120 g	120- 350 g	350- 450 g	>450 g	>120 g				
Russet Burbank		4.9	12.8	39.2	1.8	0.5	41.4	13.7	1.074	4.0	
<b>98-107-13</b>		1.5	6.1	53.0	10.9	6.7	67.4	7.1	1.080	5.0	

\*Tuber characteristics; **bold** type = suitable, plain type = questionable, *italic* = unsuitable.

# Crisp samples assessed visually: 1 - 10, 7 = borderline for French fries, >7 = too dark.

## aka Riverina Russet

### **6.3.2 “01 and “02” series fresh demonstration**

The demonstration confirmed 00-6-24 had improved culinary quality over Nadine with similar yield. However 00-6-24 was more susceptible to skin blemish disease and therefore is not a contender to challenge Nadine for summer production in the South West. The small number of entries in this demonstration reflects the lag in variety evaluation when program priorities are changed. The “01” and “02” series of breeding lines were selected for winter performance (Dawson & Mortimore 2005) under the old selection priorities of WA potato variety evaluation program. Consequently many were not suited to summer production and so selections were low in number.

### **6.3.3 “03” series district trial**

The district trial of the “03” series of breeding lines showed that no entries deserved further testing. As discussed above in the “01” and “02” series this is most likely due to the lag in variety evaluation when program priorities are changed. Only five breeding lines were tested because in the previous replicated screening (See Table 5.4.2.1.) 17/26 entries had ACD scores greater than the selection criteria. This resulted in the small number of selection available for the district trial. The amount of material suitable for testing in the Manjimup/Pemberton region will increase as specific crosses designed to produce progeny with low ACD scores become available for testing in WA.

### **6.3.4 “04” series replicated screening**

Just 21 breeding lines were available for testing and this low number reflects the severity used in culling breeding lines susceptible to ACD during the previous, unreplicated screening testing stage. Here 33 per cent (18/54) rejections were due to ACD. The replicated screening resulted in the selection of six fresh market lines and one crisp breeding line for testing in a district trial scheduled to be planted in November 2008. There is a need to develop crosses that will provide breeding lines with improved ACD for WA. Thirty-nine per cent of rejections were due to unsuitable tuber characteristics.

### **6.3.5 “05” series unreplicated screening**

This is the first stage of testing in WA from 24 fresh market breeding lines 18 selections were made based primarily on tuber characteristics. The high percentage of selections provides a good basis for the next stage where accurate cooking tests can be done. The number of breeding lines available was too small. This should be rectified in future as the WA potato industry has invested in the National Potato Breeding program and will receive around 900 seedlings for testing in future variety evaluation selection work.

### **6.3.6 Screening for blemish disease tolerance**

Susceptibility to blemish diseases is a major cause of downgrading the tuber characteristics of breeding lines in WA. We investigated whether this disease could be overcome by using chemical control methods. If chemical control was effective it would allow selection pressure to be reduced as we would not have to select for tolerance to this disease.

We were able to show that in-furrow application of azoxystrobin can significantly reduce the severity and incidence of black dot infections of potatoes (Table 5.7.2). However, although azoxystrobin was effective in reducing the incidence and severity of black dot infections,

susceptible varieties would still have levels of black dot incidence and severity that would be considered too high by wash packers and consumers.

It is therefore necessary for the variety evaluation program to continue to select for varieties that are tolerant to blemish diseases.

#### **6.4 Suggestions for future crosses for WA breeding lines**

To help ensure that breeding lines from the National Potato Breeding Program meet the requirement of the WA potato industry a list of potential parents associated with breeding lines showing low ACD scores in WA was prepared (See Section 5.8). This will help to solve the problem of unacceptably high ACD scores that was discussed above in the previous Section in relation to the low number of “03” and “04” entries in district trials and demonstrations.

##### **6.96.5 Outcomes achieved compared with objectives**

The aim of this project is to provide superior summer grown potato varieties better suited to the requirements of the WA potato industry. In particular improvement in cooking quality versatility with no after-cooking-darkening is required. The outcomes achieved have been:

- the selection of five “04” series of breeding lines suitable for testing in a district trial in 2008-09,
- the selection of 18 “05” series of breeding lines suitable for testing in a replicated screening in 2008-09, and
- the identification of potential parents that may increase the chance of producing breeding lines suited to the requirements of the WA potato industry.

The selection of these breeding lines indicates that the objectives of the project are being met.

Potato variety evaluation requires many years to produce new varieties. Thus there will be a lag before finished varieties for summer production in Manjimup/Pemberton are produced. Nevertheless, the launch of White Star at the Perth Royal Show in 2007 shows that objectives of previous projects, to wit the development of an improved winter variety, have been met. This should give confidence that the project methodology and execution is sound and that success is inevitable.

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## **6.97 Technology Transfer**

Two on-farm demonstrations were held at Pemberton in both the 2006-07 and 2007-08 season (see Sections 5.2.5 and 5.3.4).

Two meetings with the voluntary contribution provider, the Agriculture Produce Commission - Potato Producers Committee (APC-PPC) were attended and results of annual activities presented.

Several publications resulted from the launch of White Star. The Farmnote *White Star – a versatile cream skinned fresh market potato* was printed by DAFWA and is available at the DAFWA website (Mortimore & Dawson 2007).

White Star was launched at the Perth Royal Show in September 2007 (Australian Labor Party 2007) as this time coincided with the availability of sufficient retail quantities to ensure widespread availability. The launch was reported in the mass media on television, radio and the internet as well as in the daily newspaper (Perry 2007).

Information about White Star appears at the Potato Marketing Corporation of Western Australia website (Potato Marketing Corporation of Western Australia 2005) and the Western Potatoes Ltd newsletter (Western Potatoes Ltd 2008).

## **9. Recommendations**

1. The launch of White Star at the Perth Royal Show in 2007 shows that objectives of this project can be met. This gives confidence that the project methodology and execution is sound and that success is inevitable. This project should continue to be supported.
2. Parents which have previously been found to be associated with traits important for the WA potato industry were identified. These should be considered for future crosses to benefit the potato industry of WA.
3. The advanced pink skinned fresh market breeding line Flame should be commercialised. The WA potato industry should consider bidding for the rights to commercialise this high yielding, powdery scab tolerant, winter pink skinned variety.
4. The French fry breeding line 97-107-13 merits further testing.
5. Under new arrangements of the National Potato Breeding Program new exclusive breeding material will be bred for WA. The availability of breeding lines will be reduced, so to compensate, this material should be tested in WA at the seedling stage. This will mean all selection will be under WA conditions and the program will have a greater chance of success.

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- the National Potato Levy through AUSVEG, and
- Horticulture Australia Ltd.

The Department of Primary Industries Victoria supplied breeding lines and imported potato varieties for testing.

Most experiments were conducted in growers' crops and their assistance and expert crop husbandry is greatly appreciated. Special thanks to Alan Darnell, Brian and Brett De Campo and Dean Ryan. Western Potatoes Ltd and Pemberton Packers are thanked for their help in White Star launch.

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## Abbreviations & definitions

ACD	after-cooking-darkening
APC-PPC	Agricultural Produce Commission - Potato Producers Committee
BCA	benefit cost analysis
c	crisp
DAFWA	Department of Agriculture and Food, Western Australia formerly DAWA Department of Agriculture, Western Australia formerly AGWA Agriculture Western Australia
DPIV	Department of Primary Industries, Victoria
DPIV-PBP	Department of Primary Industries, Victoria Potato Breeding Program
ELISA	enzyme linked immunosorbent assay
Ff	French fry
FNECC	National Evaluation & Commercialisation Committee for the Fresh Potato Breeding Program
G	generation
g	gram
ha	hectare
HAL	Horticulture Australia Limited
HRDC	Horticultural Research and Development Corporation (now HAL)
NaPIES	National Potato Improvement Scheme
MHRI	Manjimup Horticultural Research Institute
NPV	net present value
PCN	potato cyst nematode
PLRV	potato leafroll virus
PMCWA	Potato Marketing Corporation of Western Australia
PVS	potato virus S
PVX	potato virus X
PVY	potato virus Y
SARDI	South Australian Research and Development Institute
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.
WPL	Western Potatoes Ltd

**Appendix: Example of tick sheet used for assessing tuber characteristics. This example used for replicated screening.**

Population, growth stage and tuber characteristics data for experiment number: \_\_\_\_\_

Planting date: \_\_\_\_\_

Harvest date: \_\_\_\_\_

Soil temperature at harvest: \_\_\_\_\_

Entry No.	Replicate	Breeding line	Sett spacing	Plant count	Stem score	50% emergence	50% closure	50% death	Skin		Flesh colour	Eye depth	Heel depth	Tuber				Market type	Comments	Tuber characteristics		
									Texture	Colour				Shape	Evenness	Size	Evenness					

Texture: S = smooth, N = netted  
 Depth: SH = shallow, D = deep, SL = slightly, V = very  
 Size: S = small, M = medium, L = large  
 Market Type: C = crisp, F = French fry, W = ware (fresh)  
 Shape: L = long, OB = oblong, R = round, F = flat, OBOV = obovate

Colour: B = brown, C = cream, Cr = crimson, P = pink, R = red, W = white, Y = yellow  
 (Blush/eye colour shown in brackets)  
 Evenness: E = even, U = uneven  
 Other: SLN = slightly, V = very, F = fairly,  
 Tuber characteristics: ✓ suitable, ? = questionable, \* = unsuitable.