Potato Australia

PUBLISHED BY THE AUSTRALIAN POTATO INDUSTRY COUNCIL

VOLUME 13 SEPTEMBER 2002 ISSN 1036–8558

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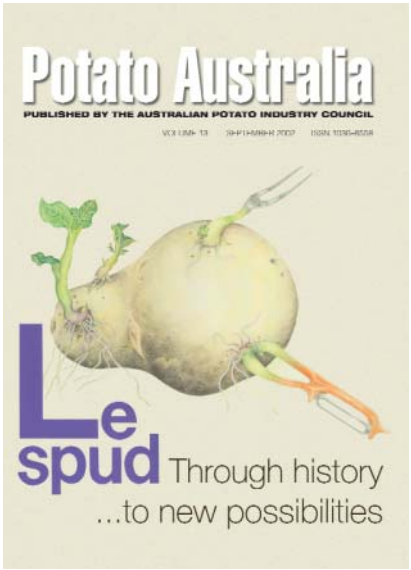

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Potato Australia

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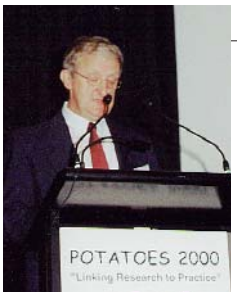

APIC report

MILTON RODDA
Chairman
Australian Potato Industry Council

Twelve months has passed since my last report and true to form potato markets across the country have again proven most volatile with dramatic decline being the norm for fresh market producers. While this situation is most unsatisfactory and frustrating for producers and to Industry as a whole it does reflect the risk producers take when operating in a supply and demand based industry.

Traditionally fresh potato production has relied on market forces to determine returns and for these forces to determine who continues to produce and at what level. This has seen a decline in the number of producers as Industry struggles to rationalise and find its own way forward. Many would argue that this is the way that a free enterprise system works and regulates itself and that this is healthy as those best able to participate continue to do so and that consumers therefore benefit from the efficiencies created in the process. Others will call for regulation and control to establish some form of protection for participants. I do not intend to make a judgement on the merits or otherwise of either view but I would venture to suggest that this debate will continue on as will the volatility of the fresh potato market.

Your Council commenced the year in a situation where it was required to reassess its role as the peak industry body for potatoes. At the annual General Meeting held in November 2001 concern was expressed that the Council was unnecessarily duplicating discussion and effort on issues already discussed by the Ausveg Potato Group and that the cost of legal and financial compliance by the Council was excessive. It was suggested that the Council lacked direction and funding and that it had become redundant. It was resolved that the winding up of APIC be canvassed with the Potato Processors Association of Australia (PPAA) and Potato Merchants Association with a decision required by 31 December 2001. As a result of this resolution Council met in Sydney during February 2002 to consider the issues raised. At this meeting all three sectors of Council reaffirmed their support for APIC to remain as the peak industry body with support for some changes to better position the Council to achieve its objectives. It was resolved that an options paper be prepared to explore the pros and cons of remaining incorporated.

At the May meeting of Council it was resolved that incorporation be moved to Victoria as this is the state which meetings are held. It was also resolved that as Council's annual income is less than $50,000 GST and BASS statements would no longer be prepared.

Council is now in a position where it is strengthened by the events detailed above having obtained renewed commitments of support from all sectors and having agreed on moves to both streamline Council and position it better financially for the future.

During this period we unfortunately lost the services of Brian Newman as our Secretary and I must take this opportunity to thank him on behalf of us all for his support and input to Council during the time he was able to assist us. A new secretary has now been appointed and I welcome with confidence Tony Imeson of Fresh State.

PPAA have unanimously resolved to seek to withdraw from the statutory levy system in favour of a system based on each member making their own arrangements regarding levy collection for R&D purposes from within their own organisations and Grower bases. The aim being to gain full control over the collection and use of monies collected. They are currently seeking support from their Growers to take to Government seeking the withdrawal of the statuary levy. Should this be successful the PPAA are committed to a smooth transition from statuary levies to a system based on voluntary levies so that projects currently running are funded to completion. In addition if successful a core breeding program for processing varieties based at Toolangi will continue to be funded from the voluntary levy subject to review at a later date. For fresh varieties discussion between parties involved are ongoing in an attempt to arrive at arrangements acceptable to all parties.

The APIC R&D Committee has now been replaced by an Industry Advisory Committee with a similar role as its task. The Committee has been structured in such a way as to more accurately represent the financial input of each of the levy payers in an attempt to secure a more balanced outcome for each of these sectors.

Finally I am happy to report that Industry has made progress on resolving the issues associated with PCN and interstate trade and that the R&D Review is finally underway. Several research projects have now been completed with additional new ones having commenced or at various levels of completion. Details of many are contained within and I compliment them for your attention.

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Growers need to drive the research agenda

If growers are to get what they want out of research they need to be more involved in the development and implementation of projects.

The Potato Levy is collected from growers and processors to fund research and development for the Australian potato industry. To obtain the best outcomes from the work, industry needs to be more involved in the projects.

This can be achieved in two ways.

Firstly, through the Potato Industry Advisory Committee or Potato IAC (previously called as the Potato R&D Committee) industry can commission work and guide the selection of projects using a Potato R&D Plan that clearly indicates the priority areas for which work needs to be done.

Secondly, industry can work more closely with research and development providers who are submitting a funding proposal to Horticulture Australia to ensure their needs are properly reflected in the proposal.

In the latter we need to improve!

How does the system work

Horticulture Australia receives requests for funding, called funding proposals, from organisations to do research and development for the potato industry. The decision as whether to fund the work rests with the Potato IAC (consisting of industry representatives) and based on the information in the funding proposal and knowledge of the committee.

Industry input

The committee always looked for evidence of industry involvement when evaluating funding proposals. Often they did not find it.

After funding decisions were made, Committee members sometimes found a project had good industry support but it was not obvious from the proposal and not known by the committee at the time of making the funding decision.

General statements in a funding proposal indicating industry support are not enough. The Committee wants to know who is supporting the project.

If growers, processors or other industry sectors are supporting the development of a funding proposal they need to make sure the application reflects their needs and their involvement is acknowledged in the application. This will go a long way in raising the importance of the project in the minds of the Committee.

Evaluating applications

There are a few blunt realities about evaluating funding proposals.

Firstly, projects are evaluated using the information presented in the proposal and the knowledge of the Committee. If there are issues that require clarification this is often done prior to the meeting where decisions are made.

Now comes the hard part! The Committee can only work with what they have and cannot be expected to understand what is happening in all the regions or sectors of the industry.

Too often funding proposals are poorly presented. The Committee has to be convinced an issue is important and the proposed work is a good investment that has an acceptable chance of success and provide a return for industry. Even when supported, some projects will still fail. Research is a risky business and some of that risk is due to factors outside the project leaders control in much the same way as growers are sometimes at the mercy of the weather.

Secondly, some issues affecting industry are so new that the Committee is not even aware of them or understand what they are about. So would you fund someone who came up to you and asked for money to solve a problem that you did not realise that you had! I think not.

There is a role for education prior to the submission of funding proposals on issues few people know about. This can be done through the potato publications.

It also needs to be remembered that Committee members are very aware they are representing other people's interests and need to make sure the work funded is likely to provide real benefits back to industry. Sometimes those benefits may also be long term such as in the instance of breeding new varieties.

Thirdly, a proposal maybe tackling an important problem but the solution being proposed is not considered worthy of funding for various reasons including that it is not likely to succeed. If the proposal has only minor flaws then the committee will tentatively support it and request Horticulture Australia to address the deficiencies with the researcher. If these are addressed satisfactorily then the project can proceed, otherwise it will be rejected.

Fourthly, the Potato R&D Committee has always had a broad range of industry and technical skills but no group of people will know everything. The new Industry Advisory Committee will have even a broader range of skills better reflecting the increasing importance of processing in Australia.

Grower frustration

Some growers feel they are in a no win situation. They talk to researchers about their needs and a proposal is

put up but it is not supported. In some cases they have tried to input into the proposal but they find it too difficult to follow due to the complexity of the application.

Researchers may be good at doing research but they do not always have good empathy with growers and sometimes are very technical in their writing. With the loss of extension staff this problem has been made worse in some areas alienating growers further from the research process.

Some groups have tried to address this problem but in many regions growers feel there is little opportunity to have input into the process in a meaningful way.

One solution is for industry and researchers to work together to ensure the best applications are put up to the Potato IAC. In Tasmania the Potato ARAC (Agricultural Research Advisory Committee) performs this role. A similar process is also starting up in South Australia (see p35 for details of how it works).

Having some mechanism in place for industry to work with research providers is important and will hopefully improve the quality of funding proposals. It also provides researchers with a better understanding of industry needs, which can impact on locally funded research programs.

Growers will need to remember though that not all research is best carried out in their own state. Sometimes the best people to do the work are located elsewhere.

If there are no arrangements in place in your state to bring research providers and industry closer together then it is up to industry to create them.

Get involved and make a difference!

It is easy to complain about not getting enough out of the Potato Levy program but you need to ask the question – is industry playing its part and driving the process by being involved in the development and implementation of projects.

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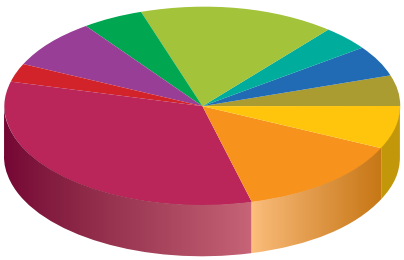
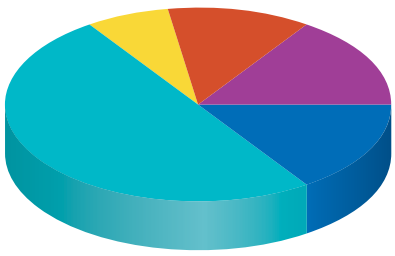
How is the Levy Money Spent 2002/2003



- Crop management 7%
- Breeding & evaluation14%
- Pest,disease & weed management 33%
- Postharvest 3%
- Seed development 8%
- Market research & development 5%
- Technology transfer 16%
- AusHort 4%
- Industry management 5%
- Unallocated money 5%

(Projects being funded are listed on pg 10 & 11)

Source of Funds for Projects in 2002/2003



- Fresh, seed & export growers 12%
- Processing growers 15.5%
- Processors 15.5%
- Voluntary contributions 7%
- Commonwealth government 50%

Horticulture Australia

Horticulture Australia Potato R&D Levy Projects for 2002- 2003

Project title	Chief investigator	Phone	Page
Review of the Potato R&D Program	Jeff Peterson, Agricultural Supply Chain Services	02 9489 7949	12
Crop management			
Coordination of the National Cadmium Minimisation Strategy	Dr Mike McLaughlin, CSIRO Soil and Water	08 8303 8433	24
Effect of calcium nutrition on decay of summer sown seed potatoes	Dr Greg Howell, NSW Agriculture	02 6951 2510	26
Factors affecting specific gravity loss in crisping potato crops in Koo Wee Rup, Victoria	Dr Ghassan Al Soboh, Agriculture Victoria	03 9210 9222	12
Potato tuber quality management in relation to environmental and nutritional stress	Stephen Harper, Queensland Horticultural Institute	07 5466 2222	28
Sustainable use of reclaimed effluent water for horticultural irrigation on the Northern Adelaide Plains, SA	Dr Daryl Stevens, CSIRO Land and Water	08 8303 6700	30
Breeding and evaluation #			
Development of genetically engineered virus resistant fresh market potatoes	James Hutchinson, Agriculture Victoria	03 9210 9222	31
Potato variety evaluation, commercialisation and adoption	Russell Sully, Agriculture Victoria	03 9210 9385	32
Evaluation and development of new potato genotypes - South Australia	Dr Chris Williams, SA Research & Development Institute	08 8303 9323	32
Potato cultivar accession and testing in Tasmania	Leon Hingston, Tasmanian Institute of Ag Research	03 6421 7645	33
Breeding Australia's potato germplasm: the resource for varietal development	Dr Roger Kirkham, Agriculture Victoria	03 9651 7205	32
Pest, disease and weed management			
Biofumigation - optimising biotoxic Brassica rotations for soil borne pest and disease management	John Matthiessen, CSIRO Entomology	08 9333 6641	34
Developing cost effective UV protection of biological pesticides	Dr Brian Hawkett, University of Sydney	02 9351 6973	35
Enhanced detection of PCN and bacterial wilt to improve quaratine procedures and market access for the Australian potato industry	Dr Robert Faggian, Agriculture Victoria	03 9210 9222	35
Common scab threshold on tuber seeds for processing potato crops	Dr Hoong Pung, Serve-Ag Research	08 6423 2044	36
Enhanced biodegradation of soil-applied pesticides - determination, risk assessment and prevention strategies	John Matthiessen, CSIRO Entomology	08 9333 6641	36
Evaluation and commercialisation of common scab resistant clones of commercial potato varieties	Dr Calum Wilson, Tasmanian Institute of Ag Research	03 6233 6841	36
Cleaning and disinfection practices for potato farms	Dr Rudolf de Boer, Agriculture Victoria	03 9210 9222	37
Control of black dot in potatoes	Dr Trevor Wicks, SA Research & Development Institute	08 8303 9323	38
Influence of rotation and biofumigation on soil borne diseases of potatoes	Dr Dolf deBoer, Agriculture Victoria	03 9210 9222	40
National PCN Management Strategy *	Gordon Berg, Agriculture Victoria	03 9210 9222	43
Prediction and molecular detection of soil borne pathogens of potatoes	Dr Nigel Crump, Agriculture Victoria	03 9210 9222	43
Management of tomato spotted wilt virus in potatoes	Dr Calum Wilson, Tasmanian Institute of Ag Research	03 6233 6841	44
Monitoring and developing management strategies for soil insect pests of potatoes	Stewart Learmonth, Agriculture Western Australia	08 9777 0000	46
Understanding the implications of pastures on the management of soil borne diseases of seed potatoes	Dr Dolf de Boer, Agriculture Victoria	03 9210 9222	50
Joint R & D program for the grains and horticultural industries for the surveillance of and control of branched broomrape	Dr Jim Fortune, Grains Research and Development Corporation	02 6272 5525	13
Management options for controlling melon thrips in vegetable crops **	Bronwyn Walsh, Queensland Department of Primary Industries	07 5466 2222	13

Project title	Chief investigator	Phone	Page
Postharvest			
Increasing the opportunities for the use of organic wastes in the Tasmanian vegetable industry*	John McPhee, Tasmanian DPIWE	03 6421 7674	50
Managing bacterial breakdown in washed potatoes	Dr Trevor Wicks, SA Research and Development Institute	08 8303 9563	51
Evaluating a product for enhancing dormancy and storage qualities of potatoes **	Ian Macleod, Serve-Ag	03 6423 2044	14
Market research and development			
"Putting the steam back into the potato market from commodity to product" – A consumer and market study	Michael Brownlee, Creative Dialogue Pty Ltd	02 9281 9611	16
The Workboot Series – The story of potatoes in Australia	Kim Field, Kondinin Group	08 9478 8326	16
Seed development			
An agronomic and economic blueprint for a round seed system for Australia's processing potato industry	John Maynard, Davey & Maynard Agricultural Consulting	03 6424 9311	52
Effects of potato seed characteristics on seed-piece breakdown and poor emergence	Dr Hoong Pung, Serve-Ag Research	08 6423 2044	14
Maintenance and refreshment of the certified seed public variety in-vitro collection	Keith Blackmore, VICSPA	03 5962 9043	14
Seed potato handling and storage – implementing best practice	Dr Doris Blaesing, Serve-Ag	03 6427 0800	16
Technology transfer			
Building strategic alliances with young Australian and New Zealand vegetable and potato industry representatives **	Brian Newman, AUSVEG	03 5790 5247	16
Communicating R&D outcomes to the potato industry through 'Potato Australia' and Eyes on Potatoes	Cathy Sage, SageWords	03 9328 5310	NR
International R&D workshop and industry extension meetings on common scab disease	Dr Calum Wilson, Tasmanian Institute for Ag Research	03 6233 6841	17
Making past industry information from R&D more accessible *	Leigh Walters, SA Farmers Federation	08 8232 5555	53
Implementing the Potato Industry's communication plan	Leigh Walters, SA Farmers Federation	08 8232 5555	54
National Potato Industry Business and Marketing Conference	Jan McIntyre, Conference Management Committee	08 8723 2624	60
Coordinating technology transfer in the Australian potato industry *	Leigh Walters, SA Farmers Federation	08 8232 5555	56

Due to the special conference report AUSHORT project reports have been held over until December Eyes on Potatoes.

- ■ - New projects that have been approved and will commence once contracts have been finalised or have commenced this year.
- ■ - Projects ending in late 2001 and 2002
- ■ - Ongoing Projects

NR No report is produced as the outcome is sent out to everyone.

\# New breeding and evaluation projects still being finalised.

* Deadline for completion extended.

** Project started in 2001 but too late for inclusion in the last *Potato Australia*.

Note – Agriculture Victoria is a business group of the Department of Natural Resources and Environment

In some cases projects that are supported for funding do not commence. Any new projects listed last year that are not listed this year did not go ahead. Projects that are listed as ending this year that were not listed last year are short term projects that are approved after the production of *Potato Australia*.

New projects approved by Horticulture Australia

Review of potato R & D program

This project will provide industry with an appreciation of the value generated by its $15 million research investment since the R&D levy was instituted in 1991.

While the prime purpose of the project is to measure the benefits that industry's investment has generated, it was agreed that a wider interpretation of costs and benefits should be employed to provide various levels of information for different purposes.

The levy and Commonwealth Government contribution will provide the basis for the analysis of the industry and Commonwealth Government investment.

A second broader analysis will include the contributions of the researchers, growers (where appropriate), technology transfer activities and other in kind supporters. It will be used to evaluate the benefits in relation to the real costs of conducting the research.

The benefits looked at will also include:

1. economic benefits to industry, for example from the reduction in input costs, or through the exploitation of a new market as the result of the R&D
2. economic benefit to processors, for example through reduced raw material purchase prices, or improved conversion efficiency
3. environmental benefit, for example through the adoption of more sustainable soil, water or chemical use practices, and
4. social benefits, for example downstream impacts on local communities in potato production or processing regions.

The measures that will emerge from the analysis will include:

1. break even point - the time taken to recover the costs of the particular piece of research or development (valuable for comparing different research strategies)
2. benefit:cost ratio - the ratio of benefits received over a given period (say 20 years), to the costs of the R&D that generated the benefit.

Project duration: 10 months

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Crop management

Factors affecting specific gravity loss in crisping potato crops

In recent years, the crisp potato industry has experienced a decline in potato specific gravity (SG) in potatoes sourced from Koo Wee Rup in Victoria. The average specific gravity of potatoes grown in Koo Wee Rup as reported by Snackbrands Australia company dropped from 1.093 in 1996 to 1.084 in 2002.

The trend has resulted in significant losses to potato growers and processors and imposed pressure on processors to increase their product price to compensate for the higher cost of processing and yield losses of processed potatoes. Low dry matter levels have also affected grower income because processors pay growers based on potato weight and dry matter content.

A literature review will collect information about the effects of various growing conditions and management practices on SG. Climatic data, soil tests, harvesting time and specific gravity data collected by processors will be analysed.

Selected individual crisp potato growers will be surveyed and a focus group, involving crisp potato growers and processors will collect information oncurrent agronomic practices and changes over the last seven years, as well as possible causes of the decline of specific gravity.

The project outcomes will be:

1. information on the main causes of SG decline in potatoes produced in Koo Wee Rup
2. suggestions for further research to improve SG.

Project duration: 3 months

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Pest, disease and weed management

Common scab threshold on tuber seeds for processing potato crops

This project aims to determine and establish an achievable and meaningful common scab threshold level that reflects field performance, regional conditions and market acceptability.

In recent studies on common scab, disease severity rather than disease incidence was shown to be more important in disease transmission. The level of common scab transmitted by a seed lot with 2% and 4% incidence of common scab was very low, and similar to one with 50% incidence.

While seedborne pathogens on tuber seeds can be an important source of disease transmission, most seedborne diseases can be effectively controlled using the appropriate chemical seed dressings. Mancozeb treatment of seeds with low disease severity has been shown to be effective in controlling the seedborne common scab.

An increasing number of seed crops are not certified due to having 4% or more incidence of common scab. Changes to the certification system, to use disease severity rather than disease incidence, could result in major savings in seed production. However, the lack of follow-on studies on common scab thresholds and resulting disease levels in the field make it impossible to define how and

what changes could be made by the processing industry.

Furthermore, although common scab is widespread on potatoes grown for processing, a high proportion of affected crops have relatively low disease severity. In processing potatoes, mild disease severity will probably result in little or no effect on yield. Yield loss only occurs if the processing potatoes have deep scab lesions.

Field trials will evaluate the relationship between the levels of common scab incidence and severity on seed, and the disease on the daughter tubers. In the trials (in fields known to have severe common scab problems), seed lines with different levels of common scab incidence, coverage and severity, will be used.

Over the three year period, common scab incidence and severity will also be determined in some commercial crops, from seed lines of known disease threshold levels. This will be to see if there is any link between common scab incidence and severity of different seed lines, and the reduction in yield due to common scab.

Project duration: 3.5 years

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Joint R&D program for the surveillance and control of branched broomrape

The grains and horticulture industries will work together to survey the incidence of branched broomrape (Orobanche ramosa) in South Australia.

Branched broomrape is a parasitic weed that may infest field and horticultural crops, especially legumes and canola, and many vegetables (eg. cabbage, mustards and carrot). If established it would present problems to the plant industries through crop loss, product contamination and potential marketing difficulties, and additional expense through altered cropping opportunities and inputs.

Currently an incursion area (70km by 70km) is under quarantine in South Australia, and there are 236 known infestations within this area. No infestations outside this area have been disovered to date.

The program will be undertaken as six separate projects; identification, diagnostics, agronomy, seeking overseas expertise, communications and survey support.

Project duration: 17 months

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Management options for controlling melon thrips in vegetable crops

Melon thrips took their toll in south east Queensland, particularly on potato, capsicum and cucurbit crops over the past season. Melon thrips were also detected in northern horticultural regions of Queensland and their establishment and spread threatens horticultural crops by affecting the quality and quantity of supply and market accessibility.

This project aims to identify and adapt management tools used interstate to potato and capsicum crops in Queensland. The focus will be on establishing sustainable control practices and providing management experience for future infestation sites around Australia. Understanding the seasonal abundance of the pest and its natural enemies, training, information and integration into other pest management practices are other aspects of the project.

Few of the 43 pesticides registered for thrips control are effective against this thrips species and little is known of its natural enemies in Queensland. Interstate and overseas field experience has demonstrated that a combination of control measures are required to avoid drastic losses to the crop.

In the Northern Territory the pest is managed by implementing integrated pest management, based on monitoring and enhancing natural enemy activity by avoiding the use of broad-spectrum pesticides. The natural enemies include predatory bugs and a soil borne pathogen. Several effective pesticides have been identified for use when necessary. Irrigation and rainfall have also been found to reduce the melon thrips population.

The project also builds on existing management tactics for western flower thrips, developed in previous and current projects. Monitoring, use of resistance management and similar natural enemies are management tools common across thrips species. However the difference in the effectiveness of pesticides and seasonal abundance make it important to consider the different species for developing management tools. The exisiting communication network for western flower thrips will be a valuable link for delivering melon thrips information.

Outcomes of the project include overcoming the sole reliance on a few pesticides for melon thrips management, effective and legitimate use of new control strategies, improved market access of produce, integration of melon thrips control into existing pest management in potatoes and capsicums, reduction in pest status of thrips and the maintenance of supply of safe, environmentally responsible produce.

Project duration: 2.25 years

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Postharvest

Evaluating a product for enhancing dormancy and storage qualities of potatoes

Currently CIPC is the only product available to control sprouting in stored potatoes. Its effects are irreversible, making CIPC unsuitable for seed potatoes. The industry is seeking alternatives to CIPC due to food safety concerns, and hazards associated with shipment and handling. This project will lead to registration of a safe alternative to CIPC and the associated increases in tuber quality for stored, seed and freshmarket potatoes.

The potato dormancy enhancer, DMN, occurs naturally in potatoes and is a safe alternative. DMN also has many other advantages over CIPC, including suitability for seed potatoes and improvement in quality of tubers coming out of storage. DMN reduces tuber respiration so that shrinkage is reduced, and refrigeration and ventilation costs are less.

DMN has been registered in the USA for several years. This project will involve commercial scale trial work to determine the optimum protocols for use in Australia. The project team will work closely with processing, seed and ware companies to determine their specific tuber quality requirements, and design protocols for DMN that meet their requirements. Research will involve developing routine methods for quantifying levels of endogenous DMN, and determining quantities required to maintain the desired physiological condition.

Project duration: 2 years

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Seed development

Effects of potato seed characteristics on seed-piece breakdown and poor emergence

Apart from seed crop monitoring and certification, there is a lack of good definition for seed characteristics, quality, and their relationship to post-harvest disease, suberisation, seed-piece breakdown, emergence and productivity. This project will take a new approach to determining measurable seed characteristics and their influence on seed-piece breakdown and field performance.

The project proposes to investigate the potential of specific gravity, nutrient analysis and rate of wound healing, as indicators of seed quality and performance.

Each season, seed-piece breakdown and poor and uneven emergence have been issues to some growers. A recent study indicated that a high specific gravity seed lot was less susceptible to fusarium rot and seed piece breakdown in laboratory and field studies, than a low specific gravity seed lot. Moreover, in the latter seed lot, there was a lack of response to mancozeb application in reducing fusarium rot. This shows that the rate of healing of cut wounds of seeds could be another useful indicator for seed quality.

Project duration: 16 months

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Maintenance of the certified seed public variety in-vitro collection

The project has three parts.

1. Maintenance of the certified seed public variety in-vitro collection. This collection of 48 varieties represents many years of selection and development by seed grower specialists and is owned by ViCSPA. The collection is maintained by the Institute for Horticultural Development (IHD) at Toolangi and Knoxfield under contract to ViCSPA. The collection is now used by growers throughout Australia and the project aims to share the cost of the maintenance of the collection across the whole industry. The collection will also include two public varieties used in Western Australia. Stocks from this collection are available from accredited laboratories that produce the "G0" stocks for registered seed growers.
2. Refreshment of the certified seed public variety in-vitro collection. Many of the cultures in the collection have been held in-vitro for more than 20 years. It is well known that off types or mutations can occur in

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varieties and/or the cultures can lose vigour. Examples are *Red Pontiac* that changes to "pink" *Pontiac*, white flowered *Sebago* (normally mauve flowered) and recently *Bintje* with very poor vigour. The Victorian certified seed industry has developed a process to minimise the risk of off-types, mutations and variety mixes being introduced into the scheme in produce from accredited laboratories (in G0 produce). It is expected to take about 10 years to "refresh" the whole collection.

3. VicSPA is providing funding towards an overseas trip by Dr Brendan Rodoni to Centres of Excellence in the diagnosis of potato diseases, including viral diseases that are a quarantine threat to the Australian potato industry (potato mop top virus and geminiviruses), in Paris, Scotland, Denmark and The Netherlands. The visit is also supported by the biosecurity program of the Victorian State Government Science and Technology Initiative. VicSPA specifically requests Dr Rodoni to gain insight into the methods used by Europeans to monitor aphid populations, particularly in relation to the incidence and control of potato leafroll virus.

Project duration: 3 years

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Seed potato handling and storage - implementing best practice

Current Australian seed potato handling and storage practices do not always result in optimum quality seed. This has an impact on the performance and yield of commercial potato crops.

The major aim of the project is to provide industry with practical guidance on how to best utilise and/or upgrade existing facilities and implement good practices cost efficiently.

The implementation of a Seed Potato Storage and Handling Manual, that supports the use of best practices, has the potential to substantially contribute to the profitability of the potato industry. An industry training program, explaining best handling and storage methods and how they can be incorporated into quality management systems, will facilitate the implementation of practices and technologies contained in the manual.

Throughout the project, the team will liase with local industry groups, storage operators, extension personnel and researchers to ensure that outcomes meet industry needs.

Project duration: 1.25 years

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Market research and development

Putting the steam back into the potato market from commodity to product - a consumer and market study

Market research and the preparation of a market development strategy for the Australian potato industry was completed in September 1993. This project will update and explore current opportunities and consumer reactions to potatoes.

The project aims to identify and measure factors affecting consumer purchase decisions and use of fresh potatoes in Australia, including consumer perceptions; attitudes towards potatoes; relevant trends; marketing of potatoes by variety and culinary use; usage and preparation; perceived quality and implications to purchase behaviour; new product development including varieties and new value added products; competing products; implications of brushed versus washed; preferred pack sizes; packaging and branded versus generic product.

The research will also determine retailer and wholesaler requirements in relation to their handling, sale of potatoes and to identify any major issues and opportunities.

Project duration: 3 months

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The Workboot Series - The story of potatoes in Australia

The aim of the project is to develop a 68 page hardcover, high quality educational Workboot Series book on the story of potatoes in Australia. This book aims to address, in part, the lack of well developed and presented educational materials for children of primary and secondary school age and their teachers and families.

The book will be written, published and marketed by Kondinin Group, a not-for-profit farmer owned and directed organisation. The Workboot Series is designed to educate children about the role and diversity of agriculture in Australia and the key issues and challenges confronting farm enterprises. Published so far are resource kits on wool, wheat, dairy, cotton, honey and timber and books on rice and vegetables. Books on beef, agroforestry and fish, and resource kits for honey and timber are about to be published.

Project duration: 1 year

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Technology transfer

Building strategic alliances with young Australian and New Zealand vegetable and potato industry representatives

In July 2000, the Vegetable R&D program supported 12 young Australian vegetable growers in a pilot project to visit New Zealand for one week, to attend the NZ Horticultural Industries Conference and visit production areas and companies involved in packing and marketing vegetables. Each participant was partnered with an equivalent young NZ vegetable grower.

Six potato industry delegates, six vegetable industry delegates and Tour Leader David Ellement, an Industry Development Officer from Western Australia, on their recent visit to New Zealand. Potato industry delegates were Mark Peters (VIC), James Hansen (QLD), David Anderson (WA), Leigh Muster (SA), Brett Conners (TAS) and Scott Beaumont (NSW).

The project was highly successful with the young Australian vegetable growers gaining an understanding of production and marketing issues in NZ, industry organisational structure including comparisons between the two countries' R&D industry involvement and promotional activities. The young growers have been sharing their experiences in their regions in organised presentations involving the industry development officers.

The project was considered successful with one outcome that these young growers are now keen to continue their involvement with industry issues including the vegetable R&D process. Ausveg is keen to capture the momentum from this initial project by repeating the project in 2002 with 12 more young vegetable and potato industry members.

The visit will include the NZ Horticultural Conference in Christchurch as well as visits to relevant production areas and businesses involved in value adding and marketing of vegetable and potato products.

Project duration: 5 months
BRIAN NEWMAN
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International R&D workshop and industry extension meetings on common scab disease

Common scab disease is one of the most economically important diseases affecting potato production in Southern Australia. This project will support a one day research workshop on common scab associated with the 13th International Conference on the Biology of Actinomycetes to be held in Melbourne in November 2003.

The workshop will bring invited world experts together with interested conference attendees to discuss the current level of understanding in common scab research and formulate joint thoughts on future perspectives for R&D activity in this area. The workshop aims to initiate and strengthen strategic linkages between research groups to create a common research focus, avoid duplication of effort and re-invention of data, and to discuss issues of specific Australian importance.

Following the workshop the project will host two industry specific meetings, one in Victoria and one in Tasmania. At these meetings keynote speakers (and local researchers in the field) from the workshop will transfer knowledge from the collective experiences of the world experts to local industry.

Project duration: 2 years
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Voluntary Contribution projects

Voluntary Contributions (VCs) are a mechanism by which Horticulture Australia can support R&D in parts of the horticultural industry that don't have access to Commonwealth matching funds through statutory levies.

In this context the word 'industry' has a broad meaning and includes growers, packers, handling and processing companies, export and domestic marketers, and the allied industries which benefit the growing industry (eg. fertiliser, chemical, transport, packaging etc companies).

Requirements

The following is a summary of the tests used to determine whether a project is funded.

- Is the project R&D?
- Is the project in horticulture? Our definition of "horticulture" includes; growers, packing, handling and processing companies, exporters and domestic marketers, and the allied industries which benefit the grower industries (e.g. fertiliser, chemical, transport, packaging etc companies).
- Is the project consistent with Horticulture Australia's or the Industry's Strategic Plan.
- Is the Voluntary Contribution sourced from cash other than Commonwealth, State or Territory government funds? HAL cannot match cash that firstly arose from Commonwealth, State or local governments. The only exception is where local government collects a levy from ratepayers to fund a particular issue (eg. environmental levy to research composting for waste disposal) and the results from this study also deliver benefit to horticulture.
- Is there market failure? This occurs when the marketplace fails to address an important industry, community or government issue due to commercial or other reasons.

There are also other checks to ensure no "double dipping" with statutory levies and that most of the benefits flow back to Australia if investments in R&D are made overseas. In some instances additional tests may need to be applied to commercial companies.

Voluntary Contribution Projects 2002-03

VC or Voluntary Contribution projects are not funded by the Potato Levy. Instead of levy money being matched "dollar for dollar" by Horticulture Australia, a contribution from a non-government organisation is matched. The money may come from a company or farmer group. This money is paid to Horticulture Australia, matched and then paid back to the Chief Investigator responsible for the project as progress payments. Except for the difference in the source of funds, VC projects are managed like levy projects. Although the funding comes from a private group the work may be done by a government department. Decisions on whether to fund a VC project are made by Horticulture Australia and do not involve the Potato Industry Advisory Committee (formerly the Potato R&D Committee).

Project title	Chief investigator	Phone	Page
Crop management			
Crop management tools for the French fry industry in the south east of South Australia	Robert Peake, PIRSA Rural Solutions	08 8724 2921	20
Study tour to USA and Europe to investigate innovation and trends with potato, carrot and onion production, July 2001	David Rann, Wesfarmers Landmark	02 9335 6307	20
Breeding and evaluation			
Evaluation of internationally bred potatoes	Michael Hughes, Queensland Horticulture Institute	07 4091 8704	20
Potato varietal evaluation for Western Australia's fresh and export markets	Peter Dawson, Department of Agriculture WA	08 9892 8461	20
Pest, disease and weed management			
Disease management of potatoes on Kangaroo Island	Dr Trevor Wicks, SA Research & Development Institute	08 8303 9563	21
Pilot commercial crop monitoring for pests and diseases in WA seed potato crops	Stewart Learmonth, Department of Agriculture WA	08 9777 0000	21
Potato pink rot control in the south east of South Australia	Dr Trevor Wicks, SA R & D Institute	08 8303 9563	21
Market research and development			
Consumer market research for fresh cut potatoes	Andrew Francey, Harvest FreshCuts	07 3879 3388	22
Scoping project to identify new horticultural opportunities for Manjimup and the South West region of Western Australia	David Doolan, Department of Agriculture WA	08 9777 0000	22
Seed development			
Nitrogen dynamics in commercial seed potato crops and its effect on seed yield, quality, storage and subsequent commercial crop performance	Dr Doris Blaesing, Serve-Ag	03 6427 0800	21
Virus testing of early generation certified seed potato crops in Western Australian	Mark Holland, Department of Agriculture WA	08 9368 3721	22
Technology transfer			
Potato Growers R&D Seminar, Ballarat, August 2001	Laurie Norman, Central Highlands Integrated Production Systems	03 5343 2555	22
Processing potato study tour to North America, July 2002	Roger Tyshing, Tasmanian Farmers and Graziers Association	03 6331 6377	22
Potato Industry Workshop and Pre-Tour to South Africa	John Rich, Tasmanian Farmers and Graziers Association	03 6331 6377	23
Publication of best environmental management practices for sustainable vegetable and potato production in Western Australia	Jim Turley, Potato Growers Association of WA	08 9481 0834	23
Seed Potato Workshop, Warragul, Victoria, August 2001	Tony Pitt, Seed Potatoes Victoria	03 5623 4788	23

■- New projects that have been approved and will commence once contracts have been finalised or have commenced this year.

■ - Projects ending in late 2001 and 2002

■ - Ongoing Projects

Voluntary Contribution projects

VC or Voluntary Contribution projects are not funded by the Potato Levy. Instead of levy money being matched "dollar for dollar" by Horticulture Australia, a contribution from a non-government organisation is matched. (See table for details p19.) For more details about the projects contact the Chief Investigator.

Crop management

Crop management tools for the french fry industry in the south east of South Australia (New)

This project will focus on collecting and adapting crop management technologies and tools to improve the quality, yields and production efficiencies of French fry production in the South East of South Australia.

Demonstration crop monitoring tools will be produced and field tested with industry.

The tools will assist growers in managing their potato crops more efficiently and sustainability. An important goal of the project is to help growers increase yields and to produce a quality product for processing that has an optimum size and weight range with reduced numbers of 'smalls'.

Project started: August 2002
Duration: 3 years

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Study tour to USA and Europe to investigate innovation and trends with potato, carrot and onion production, July 2001

A study tour was undertaken of potato, carrot and onion producing areas in the states of Idaho, Washington and Oregon of the USA and potato producing areas in Holland and Scotland by an Australian group consisting of growers, chemical distributors and researchers in July-August 2001.

The group inspected numerous farms, processing plants, chemical distributors, machinery manufacturers and research farms.

Some of the main points of interest were:

- The large scale production of potatoes that needs to be done in a limited time and the equipment used to facilitate planting and harvesting operations.
- Most of the USA potato industry was based on Russett Burbank.
- Differences in standards demanded for fresh washed potatoes between Australian and American consumers.
- The USA potato industry based on stored potatoes.
- Widespread use of fertigation and chemigation.
- Increased use of remote control of irrigation systems.
- The widespread use of large machines to apply fertilisers with air booms and variable rate applications according to soil analysis.
- Use of regular infrared aerial photographs as an aid to monitoring crop health.
- High standards of seed health maintained by regular inspection and testing of seed potato crops in USA and Europe.

Project started: June 2001
Duration: 5 months

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Breeding and evaluation

Evaluation of internationally bred potatoes (New)

A number of proprietary potato varieties that have been introduced into Australia from international breeding programs will be evaluated in Queensland to ensure they meet the needs of the crisping and fresh potato industries.

In this instance, Elders is seeking to scientifically and objectively evaluate the performance of their cultivars to provide ongoing options to the Australian potato industry. By evaluating existing varieties, the cost to the Australian industry of further plant breeding is reduced. Furthermore, new varieties have the potential to improve, yield, quality and meet new consumer niches.

Project started: November 2001
Duration: 1.5 years

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Potato varietal evaluation for Western Australia's fresh and export markets

The aim of the project is to help the Western Australian potato industry become more competitive and to expand into new export markets. Greater competitiveness and expansion in the export market will be achieved by selecting improved varieties, which will better meet market demands and better suit the growing conditions of Western Australia.

The aim is to build upon past varietal work to ensure the Western Australian domestic and export industries have suitably adapted, improved varieties to increase competitiveness and to ensure market expectations are met.

- the fresh market requires high yielding varieties with versatile culinary quality
- the export crisp trade requires varieties that have improved storage
- the fresh export trade requires potatoes with yellow skin and flesh with high yield and improved storage characteristics.

Project started: October 2000
Duration: 3 years

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Pest, disease and weed management

Disease management of potatoes on Kangaroo Island (New)

Kangaroo Island is a new seed producing region in South Australia. The growers on the island are new to the industry and need to develop their skills - particularly in disease and risk management.

To gain knowledge of the disease status currently in the industry, the potatoes will be monitored througout the season and during storage.

The project will provide important information to allow the industry to make informed decisions on how best to develop disease and risk management plans to continue producing high health status and quality seed potatoes.

Project started: August 2002
Duration: 14 months

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Pilot commercial crop monitoring for pests and diseases in WA seed potato crops (New)

Seed field inspections, a recent tuber indexing project of G2 and G3 seed crops and the performance of commercial crops have shown that Western Australian seed potato crops have very low levels of virus.

However, virus levels can rapidly increase and threaten seed quality. Recently such a problem occurred in some seed crops of the variety Russet Burbank which is susceptible to potato leafroll virus (PLRV).

To ensure that such problems are minimised, growers must be aware of the occurrence of insects that spread the virus. The best way to achieve this is to gather improved information on insect numbers through a crop monitoring program.

In the eastern states, commercial crop monitoring has resulted in improved control of insects that spread virus. Western Australian potato growers are aware of this work and wanted to test the approach locally. The project demonstrated to growers the benefits of crop monitoring through this pilot monitoring service organised by the Western Australian Department of Agriculture.

Seed crops were monitored across four growing regions in Western Australia. Weekly reports to growers showed the levels of both pest and beneficial insects. Advice on the need for control measures was provided. Objective information on the costs and benefits of crop monitoring have been presented to the seed growers, who recommended the continuation of the program for a further season.

Project started: October 2001
Duration: 1 year

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Potato pink rot control in the South East of South Australia

Pink rot, caused by the fungus *Phytophthora erythroseptica* and possibly other species of *Phytophthora*, is recognized as a serious disease of potatoes particularly in the cooler growing areas. In the South East of South Australia the disease has caused serious economic losses (over $45,000 per grower in some years) and could be a major factor limiting further expansion of the industry in that area.

The aim of the project was to develop sustainable methods of controlling pink rot in the field which would help reduce losses occurring in storage. Field studies were undertaken in the South East of South Australia to evaluate chemical means of control.

No pink rot was experienced in the trial.

Project started: December 2001
Duration: 6 months

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Seed development

Nitrogen dynamics in commercial seed potato crops and its effect on seed yield, quality, storage and subsequent commercial crop performance

Nitrogen has a major influence on yield and quality. It is difficult to manage precisely as large amounts of nitrogen can become available from incorporated plant residues and organic matter. This, and possible nitrogen fertiliser carry-over from a previous crop, can result in excessive nitrogen which may affect tuber set and seed performance.

Nitrogen flushes can also lead to growth spurts that may result in deficiencies of other nutrients within the plant. Nitrogen deficiency at any time will be detrimental to yield.

The objectives of the project have been to investigate:

- the effect of nitrogen release from crop residues and/or fertiliser carry over on seed potatoes
- whether nitrogen available from the soil bank (such as fertiliser residues, organic matter, etc.) should be included in the nitrogen budgets for seed potato crops.

Potato seed producers believe that developing a nitrogen/nutrient management system would assist in achieving the above objectives.

Work to date has indicated that the crop preceding potatoes has an influence on soil, plant and tuber nitrate levels. The exposure of seed to high soil nitrate levels influenced seed quality after storage and performance of the following crop. However, more data on the relationship between nitrogen supply to seed crops and subsequent storage and commercial crop performance is needed to fine tune nitrogen management guidelines for seed potatoes.

This project was funded by Simplot Australia Pty Ltd, McCain Foods (Aust) Pty Ltd, and Harvest Moon Pty Ltd with matching funds from the Commonwealth Government.

Project started: April 2000
Duration: 2.75 years

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Virus testing of early generation certified seed potato crops in Western Australia (New)

Maintaining low virus levels in seed potatoes presents a serious challenge under Western Australian conditions. In general, virus levels have been controlled within the seed schemes, however, serious outbreaks have occurred both concerning the domestic industry and posing a threat to the successful supply of seed potatoes to emerging export markets.

The project will identify the extent of Potato Leaf Roll Virus, Tomato Spotted Wilt Virus, Potato Virus S and Potato Virus X infection in G2/G3 seed potato crops in Western Australia. The testing will identify viral problems at the grower and cultivar levels. A statistical package will be generated to identify which crops have more than1% infection and these crops will be excluded from the WA certification schemes.

Potato growers have acknowledged the benefits and importance of the information this survey will produce in contributing to a levy to fund the project. The virus testing project will be reviewed at the end of the year.

Project started: June 2002
Duration: 9 months

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Market research and development

Consumer market research for fresh cut potatoes

An analysis of the Australian potato industry by the Centre for International Economics confirmed that there are significant opportunities for expansion of fresh cut potatoes in the Australian potato industry. Harvest FreshCuts will seek to use the knowledge gained in previous projects to determine the market for freshcut potatoes.

Surveys have shown that the potato industry needs to be more consumer focused. Fresh potatoes have lost market share to other carbohydrate foods such as pasta and rice. The industry needs to enhance consumer acceptance of potatoes through greater convenience and improved quality.

An understanding of the consumer requirements will be achieved by conducting market research on the main household grocery shopper to determine the wants and needs for this important market segment.

We need to determine Australia's untapped market for value added potato products. We will do so in this project and expand this exciting market.

Project started: January 2001
Duration: 1.5 years

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Scoping project to identify new horticultural opportunities for Manjimup and the South West region of Western Australia (New)

The Manjimup region of Western Australia is undergoing a period of considerable change. Potato processing in the region has scaled down, leaving over 600ha of irrigated land available. Forestry is being downgraded, which increases employment availability in the region. Competition is increasing in the supply of commodity type crops to the traditional markets serviced from Manjimup and Western Australia.

This project is aimed at identifying 'New Opportunities" for Manjimup and the South West of Western Australia. The project will use a variety of information sources to collect market based information on high value products that can be sourced from the Manjimup region.

Once the information has been collected, all projects will be assessed for their potential in terms of cost to enter, market potential, likelihood of success and sustainable competitive advantage.

A smaller group of projects will be chosen and analysed in greater depth for their potential as products from the Manjimup region. Commercialisation of the most promising of these opportunities will become the focus for future R&D proposals.

Project started: October 2001
Duration: 1.5 years

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Technology transfer

Potato Growers R&D Seminar, Ballarat, August 2001

This project supports the dssemination of information on research activities being undertaken within the Central Highlands Integrated Production Systems (CHIPS) catchment.

A one day seminar on 22 August 2001 at the CHIPS Demonstration Farm at Bullarook near Ballarat in Victoria was attended by 67 delegates. The major theme for the day was common scab and guest speakers included Dr Callum Wilson from Tasmania and Dr Dolf de Boer from Victoria.

Other topics covered on the day included a rhizoctonia update for the Ballarat region, pink rot update, soil loss under irrigation in potato crops, phosphorus and nitrogen availability in Ballarat soils, industry research and recommendations from McCains and the basis for last year's recommendations for high phosphorus fertilisers.

Project started: August 2001
Duration: 3 months

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Processing potato study tour to North America, July 2002

Continued competitiveness of Australian processing potato production depends on the ability of potato growers to grow produce at nationally and internationally competitive prices. Improved yields and quality through application of new technology to production may enable growers to increase returns yet still be able to maintain or enhance competitiveness.

Several grower initiated Productivity/Discussion groups have been established across the North of Tasmania over the last two years to improve information transfer with the aim of improving yields and reducing costs.

This project was requested by growers to help fund a study tour.

Twelve growers and two McCains field staff from Northern Tasmania visited research centres, McCains factories and potato growing regions in Canada and the USA during the second half of July and first half of August this year.

Key areas investigated included irrigation technology and monitoring, plant nutrition, seed issues such as quality, virus management, disease management, varieties, and emerging Quality Assurance issues in the processing sector.

A report on the tour will be published in the December Eyes on Potatoes.

Project started: July 2002
Duration: 2 months

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Potato Industry Workshop and Pre-Tour to South Africa

The project supports the attendance of ten participants (7 growers, one agribusiness adviser, one researcher and myself as tour leader) to the inaugural Southern Hemisphere Potato Workshop to be held in South Africa during September this year.

The workshop will bring together potato growers, producers, marketers and researchers from countries throughout the Southern Hemisphere. It will be an important event to establish communication linkages and facilitate on-going exchange of information of mutual interest.

The Workshop will take place in Lambert's Bay from Monday, 23 September 2002, to Wednesday, 25 September 2002.

Before the Workshop there will be a tour of the potato growing areas in South Africa which will be in production at that time, namely the Western Cape and the Northern Province, as well as visits to the South African Foundation Seed Potato Unit near Lydenburg, ARC Roodeplaat near Pretoria where the South African research and breeding programs are conducted, processors of potatoes, and a fresh produce market.

Project started: July 2002
Duration: 5 months

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Publication of best environmental management practices for sustainable vegetable and potato production in Western Australia

The project supports the publication of a Code of Practice for the Western Australian potato and vegetable industries that clearly demonstrates their ability to accept changing standards in the areas of food safety and the environment.

Consumers, retailers, exporters and governments are continuing to request more and more information about food products. This Code clearly defines the principles growers have adopted and in the Best Practices Manual are the details, which back up those principles.

In producing these two documents a great deal of research into information available was carried out by the team and the findings were widely disseminated amongst our growers and industry stakeholders for their input.

The codes will enable the vegetable and potato industries in Western Australia to actively promote their products and most importantly, offer a level of assurance that the processes in producing these products are acceptable.

The Code of Practice was launched by the Minister of Agriculture on 2 August and then posted out to all potato and vegetable growers in Western Australia.

Project started: March 2002
Duration: 3 months

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Seed Potato Workshop, Warragul, Victoria, August 2001

The project supported a seed potato workshop at Warragul, Victoria on 20 and 21 August 2001, jointly convened by Seed Potatoes Victoria and the Victorian Certified Seed Potato Authority. There were 125 registered participants and 32 trade exhibitors at the event.

Seed potato growers dominated as participants but there was also representation from across the whole industry. Over 20% of the participants were from outside of Victoria.

The program included two overseas presenters. Professor Paul Struik from Wageningen University in The Netherlands spoke on the physiological age of seed and Cameron Duff, National Manager of the Potato Section of the Canadian Food Inspection Agency addressed seed certification.

The workshop included a half day trade fair at Farm World with the theme of planting potatoes. Although rather wet, everyone made the best of the situation with trade exhibitors using the opportunity to demonstrate and inform workshop participants of the latest developments in technology.

Project started: August 2001
Duration: 2 months

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National Cadmium Minimisation Strategy

Your Levy @ Work

Australia has adopted a strategy to maintain safe levels of cadmium in its agricultural soils and produce. The National Cadmium Minimisation Strategy, commissioned by the Plant Industries Standing Committee (PISC*) provides the framework to address issues concerning the accumulation of cadmium in agriculture.

Currently, all States are developing complementary cadmium regulations for inorganic fertilisers. However, there are still concerns regarding the input of cadmium to agricultural soils through the re-use of organic fertilisers and wastes such as sewage biosolids.

A national workshop in Melbourne in February 2002, brought scientists, regulators, and the water industry together to discuss cadmium loadings to agricultural soils through disposal/use of organic wastes such as sewage biosolids.

Agreement was reached at the workshop to:

- review controls at source (i.e. trade waste policies) and traceback of cadmium in biosolids in treatment works with high cadmium concentrations to determine where additional controls are needed on influent concentrations (ie. concentration of cadmium in material coming into the treatment works.)
- set the maximum annual loading rate of 30g/ha/yr averaged over five years (150g/ha/5yr)
- set the maximum soil concentration at 1.0 mg/kg, unless local data indicates a lower limit
- adopt, when finalised a national guideline for biosolid cadmium grading
- undertake research towards a soil/biosolid bio-availability index and sustainability system
- encourage an analytical quality assurance program through the Australasian Soil and Plant Analysis Council
- consider controls on cadmium in wastes other than biosolids (e.g. other animal and urban wastes and composts).

A national database of cadmium in food crops has been developed and a website for the National Strategy has been established at www.cadmium-management.org.au.

Best Management Practice brochures for growers, and other information relating to cadmium, can be accessed through this site.

** Formerly the Standing Committee on Agriculture and Resource Management -SCARM.*

This project is jointly funded by the Fertilizer Industry Federation of Australia, Grains Research and Development Corporation and Horticulture Australia on behalf of horticultural industries including potatoes and the Commonwealth Government.

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CONTROL FREAK

Rhizoctonia solani is a serious fungal disease that attacks potatoes. It exists as different strains, divided into anastomosis (AG) groups.

RIZOLEX® controls the major strains of ***Rhizoctonia*** that effect potatoes in Australia[1], giving you maximum protection against black scurf.

Do you know which strain of *Rhizoctonia* you have present?

Comparison Study[2]

Strain of ***Rhizoctonia solani***	RIZOLEX	MONCEREN*
AG-3	✓✓✓	✓✓✓
AG-4	✓✓✓	✓
AG-5	✓✓✓	**X**

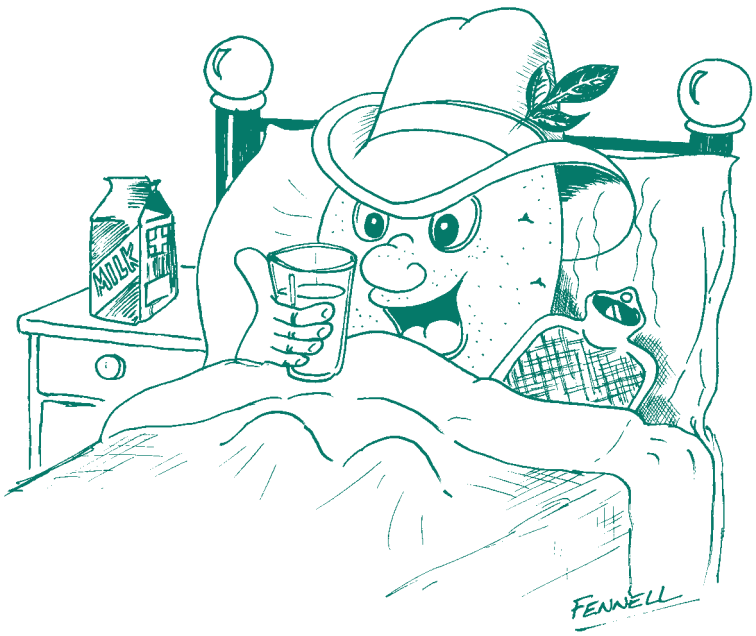
✓✓✓ Good control ✓ Limited control **X** Poor control

RIZOLEX 100D
- Simple to apply
- No wetting of seed piece
- **IT WORKS**

SUMITOMO CHEMICAL

1. Balali et al. Anastomosis group and pathogenicity of isolates of *Rhizoctonia solani* from potato crops in South Australia. Plant Pathology 1995
2. Data on file

Effect of calcium nutrition on decay of summer sown seed potatoes



Using fertiliser applications in ware crops to increase tuber calcium levels and therefore increase their resistance to soft rot does not appear to work according to this research. However, careful management of a seed block and selection of correctly sized daughter tubers could reduce the population of infected tubers retained by growers.

This study supports the view that soft rot or *Erwinia* transmission from parent to progeny tubers occurs in addition to being acquired through mechanical injury.

In the absence of washing or cutting seed, parent to progeny transmission is probably one of the main ways the disease is transmitted. Even when the bacteria is present in seed pieces at planting, crop establishment and yield potential are unaffected as long as other risk factors such as high temperature, or low oxygen conditions do not coincide with this period. This is backed by the observation that during cool storage, tubers do not rot, but afterwards, large tubers appear to be more susceptible to rot. This is presumably due to decreased oxygen availability in larger potatoes due to their reduced surface area to volume compared to smaller tubers.

Any soft rot management strategy should aim to minimise the crop's bacterial load and not just take out potatoes with obvious signs of rot during the weeks following harvest. To maintain a high *Erwinia* load risks consumer loyalty to the product or gambles low crop establishment costs against the possibility of high disease.

Low crop establishment costs also have to be weighed up against the option of buying more expensive but clean certified seed.

Control options for tubers produced by ware growers

As *Erwinia* can live inside tubers, even the most rigorous surface disinfection techniques will be ineffective.

If seed tubers are to be produced by ware growers then growers need to manage a seed block rather than grade out seed from their previous crop. In a seed block, infected plants could be rogued and at harvest, tubers unsuitable for seed graded out.

Loss of seed pieces due to tuber rots can reach devastating proportions and in some circumstances the crop may have to be resown as the yield potential from the remaining crop would not make it economically viable to grow it through to maturity. Soft rot is the main cause of seed loss in the Riverina, Murray Irrigation Area and other sand hill producing regions.

Clearly, the presence of the *Erwinia* bacterium is the main predisposing factor for the disease. By tracing the origin of growers' seed, the study found that growers using certified seed experienced little loss.

Certified seed or replant tubers

Some growers however achieved equivalent results using seed they had produced themselves. Deliberately infecting these tubers with *Erwinia* showed they were not particularly resistant, which shows that some growers are choosing tubers free from the disease.

Choosing seed free from disease is fairly easy if you're prepared to pay for certified seed. However, with crop establishment being one of the largest input costs in potato farming with certified seed costs alone ranging from $1260 for older varieties up to $1820 per hectare for Plant Breeders Rights protected material, most ware crop growers take the risk and replant tubers graded from their previous crop.

So how do some growers avoid *Erwinia* – is it good luck or good management? The answer may lie partly in the tuber's growing environment and partly with the grower's tuber selection strategy.

The nature of the silent epidemic

Once potatoes have established tops, most growers don't worry about what happens to the mother tuber unless of course the crop succumbs to the disease blackleg, caused by *Erwinia carotivora* ssp. *atroseptica.*

Blackleg destroys newly established crops by invading and rotting stems and tubers in seasons typically cooler than those, which result in seed piece losses from soft rot.

It appears that *Erwinia* can live unnoticed in tubers as do many other bacteria. Other researchers have discovered that *Erwinia*'s capacity to manufacture decay causing enzymes isn't turned on until there is enough bacteria in the affected tissue. This explains why there is never "a little bit of rot" on affected tubers.

Erwinia diseases can hide and emerge only when the correct conditions arise in susceptible potato varieties – mainly in hot, low oxygen wet conditions.

In controlled environments, outbreaks should be able to be predicted or avoided by altering the prevailing temperature and oxygen levels, but this does not explain how growers themselves appear to amplify the disease in one generation æ sometimes to devastating proportions. Here the answer lies not with the bacteria but with the nature of the potato plant itself.

Mother – daughter relationships

Depending on physiological age, each mother tuber gives rise to one or more shoots. These shoots in turn give rise to stolons that terminate and mature into the daughter tubers that are subsequently harvested - but what is the fate of the mother?

Mother tubers, having given up their nutrient and starch reserves to the establishing plant, seldom survive to crop maturity and harvest æ they rot away. This overlooked fact is the key to how *Erwinia* infected tubers amplify in field generations because not only are *Erwinia* spp. responsible for the eventual decay of many mother tubers, but it is how long the mother tuber remains alive and attached to the new plants that determines the size of the daughter tubers.

While further work would be required for confirmation, it appears that by retaining certain size classes of tubers from their crops, growers may be inadvertently selecting a population of tubers that contain more *Erwinia* than the tubers set by uninfected plants. Under last year's field conditions the 100-150g class became over represented, however this category would probably change depending on the timing of seed tuber loss.

In the presence of *Erwinia*, mother tubers are always at risk of decay, especially when conditions favour bacterial growth over their own growth such as during high temperature, low oxygen periods or when they exhaust their nutrient reserves as a normal part of their vegetative reproduction cycle.

Just when an *Erwinia* infection manifests itself depends very much on climatic or cultural factors. In hot weather, the stresses may be so great that seed tubers rot in bins before planting or it may be rain after planting that seals the soil surface by creating a crust causing oxygen levels to plummet, triggering soft rot. In cooler years, this may lead to black legging in the crop or later, an early dying off of occasional plants or it may be totally silent. Timing of rot can mean the difference between tragedy and triumph for the grower.

Increased yields can be a consequence of soft rot bacteria where the mother tuber is lost after the plants become established. In healthy plants, the link between the shoot systems is maintained through the mother tuber until just before harvest when it rots away. This is not the case in plants where individual shoots prematurely separate because the mother tuber has rotted. In such plants, each shoot effectively acts as a separate plant and the number or size of its tubers cannot be affected by other tubers forming on stolons not directly connected to it.

Danger for Australian sand hill producers

Ware potato crop growers generally pay for certified seed only for their spring planting in August/September. This crop is harvested in late December at a time when temperatures and evaporation from plants are high. This period is especially stressful for plants grown on sand hills as these soils have poor waterholding capacity and lose and gain heat quickly in their dry state especially if the soil is exposed through wilting plants.

Certified seed is not grown, handled or replanted in aseptic conditions so growers cannot expect their crop to be free from *Erwinia*. As temperatures climb, watering becomes critical. Under these conditions, *Erwinia* numbers reach critical levels and the mother tuber rots. Unfortunately for some growers this may mean an increase in the proportion of infected tubers in the size class they intend to retain as seed for their next crop. This second crop is usually planted in late February.

Climatic conditions in Australian sand hill growing regions generally remain stressful during February/March. Any delay in planting until soil temperatures are lower means the grower faces decreased yield from the shorter growing season before the winter frosts and harvest in June. During February/March growers should expect that right conditions for soft rot will occur early in the potatoes' growth cycle and if *Erwinia* is already on or in the seed, the risk of breakdown is very high. If the grower has unintentionally amplified the proportion of diseased tubers in the planted population, the results may be catastrophic.

This project is made possible with the assistance and cooperation of Riverina and MIA potato farmers.

Funded by Horticulture Australia on behalf of the potato industry and the Commonwealth Government and undertaken with the assistance and cooperation of Riverina and MIA potato farmers. Project started July 1998.

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Understanding brown fleck

Understanding the causes of brown fleck will help in the development of a management package to reduce it in potato crops.

During 2001 researchers gained a better understanding of brown fleck, a disorder that discolours the internal flesh of tubers and reportedly attacks large, rapidly growing tubers.

Experiments in winter 2001 evaluated the effects of day and night temperature and boron and calcium nutrition on incidence of brown fleck.

The research showed high night temperatures created favourable conditions for brown fleck. Experiments with calcium and boron showed that, although these nutrients may reduce the incidence of brown fleck when used separately, in combination they interacted negatively.

High night temperatures favour brown fleck symptoms

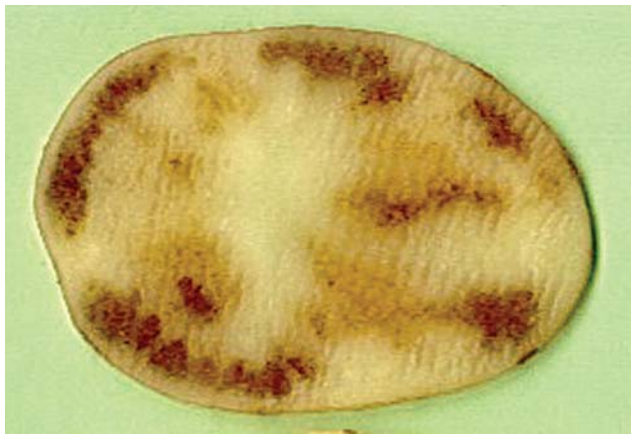
Earlier trials had found that temperature alone did not cause brown fleck, confirming its status as a complex disorder requiring relatively unique circumstances in which to occur.

In 2001, an experiment evaluated the effects of high day temperature, high night temperature and heat units on brown fleck incidence. The temperature treatments included four day/night regimes - 18°C/13°C, 23°C/18°C, 28°C/13°C and 28°C/23°C - imposed at 100 days after planting (about 10 days before the dying off of the crop).

High night temperatures dramatically increased the severity of brown fleck symptoms whereas high day temperature did not greatly favour brown fleck development. Despite a mean temperature of 20.5°C in both treatments, the summed heat units (mean temperature) were not a critical factor in the development of brown fleck symptoms.

Brown fleck was evident in the 18°C/13°C treatments at very low levels, suggesting temperature alone does not cause the disorder although it enhances symptom development.

Brown fleck in tubers



Heat necrosis in tubers

High soil temperature not a factor

The mean soil temperature during the treatment phase was lower in the 23°C/18°C regime (20.56°C) than in the 28°C/13°C regime (21.73°C) but the brown fleck incidence was higher. This indicated that night temperature in plant foliage and probably not soil temperature, was the major factor influencing the expression of brown fleck.

Observations of internal disorders in the field suggests that high soil temperatures may cause a disorder similar to brown fleck, commonly referred to as heat necrosis or internal heat necrosis (IHN).

Effect of temperature on the incidence of Brown Fleck in potato tubers expressed as the mean affected area (sq mm).

Temperature	18/13	23/18	28/13	28/23
Incidence	2.3	112.4	21.2	144

Boron, calcium play a role

A field nutrition experiment evaluated the effects of boron at 0, 1, 2 and 3 kg/ha in combination with calcium at 0, 50 and 100 kg/ha.

A preliminary analysis of data indicated boron at two and three kg/ha reduced the incidence of brown fleck. Similarly, calcium at 100 kg/ha reduced the incidence of brown fleck. The graph below shows the brown fleck data expressed as a percentage of the brown fleck incidence in the 0 calcium 0 boron treatment.

There was a negative interaction between calcium and boron, on the incidence of brown fleck. The combination of a high rate of calcium (100 kg/ha) and boron (2-3 kg/ha) was not as effective at reducing brown fleck incidence as the calcium or boron rate alone. This result cannot be easily explained.

These results should be viewed with caution until further experimentation can better define the effect of these nutrients.

Outcome

This research has demonstrated the complexity of brown fleck and the relatively unique conditions required to induce the disorder. This is consistent with field observations where specific seasonal conditions, particularly those favourable for rapid growth and high yield potential, are required to induce brown fleck.

In the coming year, glasshouse and field experiments will further evaluate the effects of boron and calcium on the incidence of brown fleck. The effects of removing green tops during tuber bulking will also be evaluated. A soil temperature study will help clarify the causes of similarities between brown fleck and internal heat necrosis symptoms.

Funded by Horticulture Australia on behalf of the potato industry and the Commonwealth Government

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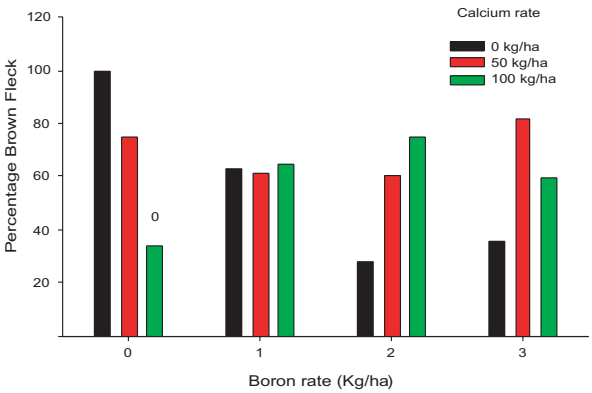

Effect of boron and calcium rates on the incidence of brown fleck. Brown fleck is expressed as a percentage of the brown fleck recorded in the 0 kg/ha calcium 0 kg/ha boron treatment.

Training tools for reclaimed water use in horticulture

A new manual is now available to help growers (including potato growers) using reclaimed water to manage their soil and water resource.

The manual combines soil and water research from Horticulture Australia's project 'Sustainable use of reclaimed water for horticultural irrigation on the Northern Adelaide Plains' and data from a Natural Heritage Trust (NHT) funded project that focused on the socio-economic implication of reclaimed water use.

A reference manual on reclaimed water use, targeted at horticultural advisors, and a text book: *Reclaimed Water use in Horticulture - an Australian Perspective* are now being developed. These publications will provide information to develop sustainable reuse schemes in Australian horticulture. If all goes to plan, these should be published early next year.

The user manual was a collaborative effort between PIRSA Rural Solutions, Adelaide University (Department of Soil and Water) and CSIRO Land and Water and is the final output of the NHT project. A copy can be purchased from Howard Hollow, PIRSA, Lenswood Centre Ph: (08) 8389 8800.

Funded by the vegetable and potato industries and the Commonwealth Government. The grower manual was funded by Primary Industries and Resources South Australia and the Natural Heritage Trust. Project started January 1998.

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Development of genetically engineered virus resistant fresh market potatoes

This project continues to develop potato cultivars with resistance to Potato Leaf Roll Virus and Potato Virus Y. About 150 genetically modified plants made up of the cultivars *Sebago*, *Crystal* and the breeding line *80-90-5*, each with four different genes designed to control PLRV and PVY have been produced and tested in glasshouse trials. About 50 lines representing all cultivars and most gene constructs are now being evaluated.

Aims

- evaluate selected lines in further glasshouse trials and select new lines that grow and yield satisfactorily as well as resist viral infection
- transfer anti-viral genes to new cultivars genes. Targets will be new lines coming from the breeding program. This will allow us to add further value to both the conventional and biotech programs
- apply technologies developed to genetically modify potatoes for resistance to bacteria and fungi

Funded by Horticulture Australia on behalf of the potato industry and the Commonwealth Government. Project started July 2001.

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Potato varieties

The potato breeding and testing program has developed varieties specifically for Australian markets. A number of new varieties have been released after collaborative trials with the industry.

The Victorian Department of Natural Resources and Environment (NRE) operates Australia's only potato breeding program and maintains a large gene pool at the Toolangi Research Station. A potato seedling population is produced and grown at Toolangi for three field generations and lines are selected for testing in commercial production areas. In the third year fresh market type seedlings are also tested in a powdery scab disease screening site at Frankston and a winter production site in the Murray Mallee of South Australia.

Trials run by state Departments of Agriculture are located on commercial growers' properties and testing of new varieties in a series of independent trials is an essential part of the breeding program.

Seed potatoes from Toolangi

Recent Releases

Commercial crops of *Lustre, Dawmor, Ruby Lou* and *Eureka* were all grown during the 2001-02 season.

Most of these new varieties have been identified as 'low input' varieties. Their improved disease resistance means less chemical protection is required and their improved vigour allows reduced inputs of irrigation, fertiliser and herbicides.

Lustre - a new fresh market variety

Lustre, produced by crossing *Crystal* (USA) with *Coliban* (Australia), has excellent cooking qualities. It boils well with little sloughing and minimal darkening after cooking, making it suitable for potato mash and salad. It is also acceptable for roasting, but only fair for frying. *Lustre* has excellent flavour.

Plants have short dormancy and short growing period, early tuber bulking and the potential for high yield. *Lustre* tubers have smooth, bright white skin and are suitable for washing packing. Tubers have regular round shape and are evenly sized.

Lustre has performed best in the Riverina and Murray Mallee from seed saved crops harvested in winter. It produces many more tubers per plant than *Coliban* (11 to 7) and most are in the small to medium range (80-350g) with few that are large or oversize. It is advisable to plant *Lustre* with wider spacings to ensure adequate and even soil moisture levels throughout cropping for optimum yield.

Dawmor - a new crisping variety suitable for export

Spring planted crops in the Manjimup/Pemberton region of Western Australia have produced very high yields of round, medium sized potatoes.

Dawmor has a longer growing period than *Atlantic* (up to four weeks) and sets many more tubers. *Dawmor* has higher yields, similar dry matter but less internal disorders than *Atlantic*. Strong plants that live long enough to fill out high tuber numbers are its major advantage. If *Dawmor* can be grown out to its full potential it can offer export growers a more profitable crop than *Atlantic*.

Crisp quality and storage are excellent with most production being well received by export markets.

Last year, *Dawmor* seed was tested in Indonesia on a small scale. Results are promising with *Dawmor* producing much higher yields than *Atlantic* while having good processing quality.

Ruby Lou - a new red skin fresh market variety

Ruby Lou is establishing itself as a standard red skinned variety in South Australia and Western Australia.

Plants have vigorous growth and have resistance to target spot disease. Crops grown for harvest in winter have better tuber shape, higher marketable yields and darker red skin colour than *Desiree*. *Ruby Lou* has a short growing period and short dormancy and is more suited to double cropping programs than *Desiree*.

Ruby Lou tubers are resistant to common scab disease and resistant to skin scuffing and shatter crack tuber damage.

Eureka - a versatile all rounder for the WA fresh market?

Commercial testing of *Eureka* in Western Australia has had mixed results. While pack-outs have been comparable with *Delaware*, demand for *Eureka* is literally non-existent.

Field Day at Kalangadoo

Is this a case of retailers and packers being unfamiliar with the variety?

Some stocks have gone for processing as French fries where they were well received. Some other problems have been splitting (particularly under cooler harvest conditions), after cooking darkening (ACD) and poor shelf life.

Despite its precarious position, *Eureka* remains on Western Potatoes preferred variety list. *Eureka* now has a price look up (PLU) code so retailers should have no real objections to including it in their schedule. Western Potatoes current attitude to the development of *Eureka* is to let market forces dictate.

Eureka is also being tested as Riverina Russet for the French fry market in the eastern states and small commercial plantings have been produced in the past two years.

New lines in trials

A number of new lines have been outstanding in variety trials and small commercial tests during the past season. These will continue to be tested in trials while being multiplied in certified seed potato programs in the coming season.

***Auski* (left) and Nadine (right). Auski may not have perfect shape and skin but its yield and culinary quality are a powerful combination.**

Auski - a fresh market variety with outstanding yield and cooking quality

Auski has performed well over summer in Manjimup. Benefits to industry are its combination of high yield and good cooking quality. For example the average of five trials planted in October/November show an average yield of 72 t/ha (*Nadine* was 57) with a fry colour of 4.0 (*Nadine* was 8.5). Specific gravity was much higher than *Nadine* (1.065 compared with 1.051). Shape and skin are not perfect but compare reasonably with *Nadine* from the same site.

Barman - a French fry with improved tuber shape and fry processing

Barman has produced the best long shaped tubers for fry processing when grown on sandy soils. It has high dry matter and fries to a light colour at harvest and after long term storage. Plants are resistant to target spot - the major disease in South Australia.

Tasmanian French fries

Six new French fry varieties and breeders' lines are currently the subject of large scale commercial evaluation in Tasmania, with processing companies conducting advanced trials and processing tests on their particular selections.

Industry personnel and researchers made 31 preliminary selections, from a total of 85 new accessions in 2001-02. Seven reselections were made from replicated trials of 24 lines selected in 2000-01 and a further seven lines were also reselected from lines re-selected in 1999-2000.

Farmers looking for a winner at the harvest of a trial grown in a commercial crop.

Graeme Henman (SAFRIES/McCains) and Roger Kirkham inspect trial plots of Barman.

Acknowledgments
We would like to thank growers, processors and potato packers who have helped with variety testing. This work is funded by the State and Commonwealth Governments and the potato industry.

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Improving the effectiveness of biofumigation

The effectiveness of biofumigation using Brassica plants for suppressing soil borne pests and diseases can be maximised if the plants are pulverised and thoroughly watered, research has indicated.

Although further work is required to test the results under different conditions, this research has shown that pulverising Brassica plants in a mulcher or using a freeze/thaw method maximised the release of toxic isothiocyanates (ITCs) into the soil. ITCs are compounds in the same chemical family as the methyl ITC (MITC) produced by metham sodium soil fumigant.

Thorough watering helps

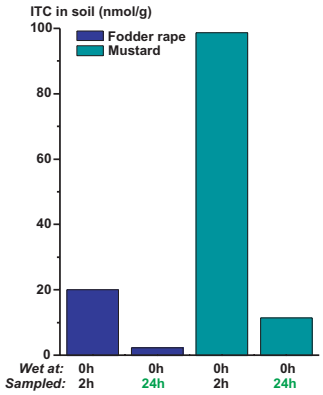
The research also showed that a thorough (42 mm) watering produced a flush of ITCs and periodically reactivated ITC production, and most likely assisted the dispersal of the ITCs through the soil.

The results suggested that growers who watered heavily immediately after mulching a biofumigant crop could further benefit from leaving the pulverised plant material on the soil surface. Further work is needed to see how long the interval between mulching and watering could be before losing the effect through drying of the mulch.

Growers unable to water quickly may be better off incorporating the mulched plant matter and watering later as later applications of water caused ITC release. The reactivation effect seems to last for some time, apparently more so for fodder rape than mustard.

It seems likely that the amount of water required for maximum effect will vary with the soil type. The researchers examined only two widely different simulated irrigation levels (14mm and 42 mm) in a single soil type in the field. In the loam soil, the beneficial effects were not strongly evident with 14 mm, yet 42 mm may have been more than the minimum required to obtain the effects.

Mulching and immediate rotary-hoe incorporation of fodder rape.



Concentration of ITCs in soil following mulching and leaving mulch on the surface, with the mulch and soil wet immediately and sampled either two or 24 hours after that, for fodder rape and mustard.

Field studies

An extensive range of field experiments were conducted to test the effects of various incorporation techniques on the amounts of ITCs in a sandy loam potato soil at Busselton, Western Australia. Two brassicas, a fodder rape and mustard were sown in mid-June.

Plant treatment and incorporation were carried out in the first week of October when the mustard was in the early stages of flowering. The plants were chopped and incorporated simultaneously with a rotary hoe, or the above ground parts were pulverised with a mulcher.

The mulched plant tissue was either left on the surface of the ground, or was immediately incorporated into the soil using the rotary hoe.

Every treatment resulted in an early 'spike' of ITCs in the soil. However, mulching and immediate rotary hoeing resulted in five to 10 times greater ITC concentration than rotary hoeing alone or mulch left on the surface – a substantial improvement, especially noticeable for the mustard.

Both rotary hoeing and mulching without incorporation caused only a very brief and low level 'flush' of ITCs, with concentration dropping quickly during the first two hours. In contrast, the combined mulched and rotary hoed material actually slightly increased the ITC concentration in the soil during the first two hours before declining relatively slowly over 1-2 days, with the mustard showing the best persistence.

Further research is needed to capitalise on these encouraging results and test their effects under different situations.

Funded by Horticulture Australia on behalf of the potato and other horticultural industries and the Commonwealth Government. Project started July 2000.

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Your Levy @ Work

Developing cost effective UV protection of biological pesticides

Growers using Integrated Pest Management or IPM already incorporate biological pesticides into their programs where these are available and effective enough to reduce 'hard' chemical use.

However, many potentially good biological pesticides are made ineffective by their susceptibility to the sun's rays. Providing effective protection for these pesticides will lead to more becoming available and those presently in use becoming more effective.

This project looks at developing titanium dioxide as a sunscreen to protect sun-sensitive biological pesticides in integrated pest management programs.

It is part of ongoing research to minimise the use of 'hard' (broad spectrum anticholinesterase) chemical pesticides and replace them with biological pesticides.

Inorganic pigments such as titanium dioxide and zinc oxide have been used as sunscreens for many years. However, this sort of technology has not yet been successfully exploited for the protection of sun sensitive biological pesticides.

The potential for titanium dioxide as a UV protection agent has been demonstrated in an earlier Grape and Wine Research and Development Corporation funded project. However, further ideas and developments are needed to create a viable system for field application. This project will explore these ideas and develop them to a point where industry assistance can be found to develop a product.

Preliminary work has started on diamondback moth and heliothis and the first test formulation will be delivered shortly.

If this project is successful growers can expect improved performance from soft pesticide options.

Funded by Horticulture Australia on behalf of the potato industries and the Commonwealth Government. Project started in December 2001.

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Your Levy @ Work

Enhanced detection of PCN and bacterial wilt to improve quarantine procedures and market access

Scientists at Agriculture Victoria are using cutting edge DNA tools to enhance Australia's diagnostic capability for detecting bacterial wilt and Potato Cyst Nematode.

Agriculture Victoria and New Zealand's Crop and Food Research are collaborating to develop highly sensitive DNA based detection methods for quarantinable potato pathogens. Scientists at Knoxfield in Victoria have spent the last year developing new diagnostic tests for bacterial wilt, while Crop and Food Research has been working on similar tests for potato cyst nematode (PCN).

The new diagnostic tests, which use forensic science technology, will eventually replace cumbersome techniques such as elutriation, forking and bacterial culturing. Because of their accuracy, the tests will enable rapid phytosanitary surveys of potato production areas for declaration of area freedom, which has the potential to improve market access.

More than a dozen molecular tests worldwide have been put through their paces using local soil, potatoes and water samples. The most accurate and sensitive of these have been tested alongside the more traditional but cumbersome tests (for example; forking, elutriation, bacterial culturing, bioassays). So far the DNA tests have proved to be significantly more sensitive than traditional tests while taking only a fraction of the time to carry out. The tests will be used to survey areas in New Zealand and Australia with known histories of bacterial wilt and PCN and the results compared with disease in the potato crop.

The next phase of the project will concentrate on two areas of research:

1 Disease surveys and validation of the diagnostic test processes.

2 Developing the tools to predict disease levels prior to planting.

Funded by Horticulture Australia on behalf ofthe potato industry and the Commonwealth and Victorian Governments. Project started in July 2001.

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Your Levy @ Work

Enhanced biodegradation of metham sodium - what we have learned

Metham sodium is an effective and widely used soil fumigant in Australian horticultural crops.

However, its effectiveness can be reduced due to biodegradation by soil bacteria and, as this research project found, high soil pH.

Researchers identified a severe case of enhanced biodegradation of metham sodium on an intensive vegetable production enterprise, where the fumigant had been used at least yearly for more than a decade. Metham sodium, that normally took more than two weeks to disappear from the soil, was biodegraded in only seven hours. Other less severe instances have occurred in various parts of Australia.

High soil pH and sandy soils were found to be major risk factors and growers were cautioned to avoid combining frequent metham sodium treatments with liming.

Biofumigants may be affected

Soil with enhanced biodegradation of metham sodium may reduce the success of biofumigation as an alternative, as the soil organisms also degrade the toxins from biofumigants.

Increasing the number of applications and decreasing the time between applications increases the risk of developing enhanced biodegradation. Once the process starts, subsequent applications may dramatically increase the severity of biodegradation to a point where it becomes a serious problem.

The bacteria that cause enhanced biodegradation are very tough, so recovery is slow for soils that have developed a problem.

For most potato growers, this research project has shown that enhanced biodegradation of metham sodium is not currently a high risk for the industry, as its use is not usually as numerous or frequent as in other vegetable production enterprises.

However, growers need to be aware of the issue of enhanced biodegradation of soil applied pesticides and the risk factors involved to avoid a potentially serious pest management problem. There are no simple cures once soil is affected and recovery is very slow.

Funded by the vegetable and potato industries, the Australian Processing Tomato Research Council, Queensland Fruit & Vegetable Growers and the Commonwealth Government. Project started February 1999.

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Your Levy @ Work

Development of extreme resistance to common scab

Resistance to common scab disease is important to improving the sustainability of potato production.

The project is developing durable resistance, or immunity, to common scab by examining tolerance to the toxin *thaxtomin* produced by the pathogen during infection.

A system for producing moderate quantities of highly pure *thaxtomin* required for the study has been developed.

Mutation and cell selection techniques have been used to select multiple lines of cvs *Russet Burbank*, *Shepody*, *Desiree* and control cv. *Iwa* which are able to grow in the presence of *thaxtomin*.

Regeneration of cell lines for production of potato plants has recently been successfully achieved producing lines of *Russet Burbank*, *Desiree* and *Iwa*. These are currently being bulked for evaluation for toxin tolerance, disease resistance and agronomic performance.

Disease challenge trials should prove that the resulting plants have resistance to common scab. In Tasmania, studies have shown that all strains of the disease produce *thaxtomin*, a potentially important factor in future breeding programs.

Funded by Horticulture Australia on behalf of the potato industry and the Commonwealth Government. Project started July 1998.

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Cleaning and disinfestation practices for potato farms

High pressure washing of potato bins

This project examined issues of hygiene on potato farms relating to contamination of seed potato stocks with pathogens causing common tuber diseases. Potato sheds and cool stores were recognised as high risk areas because of dust, airborne spores and potato slurry concentrations that coat bins and equipment.

In recent tests on powdery scab, a gram of shed dust was found to be more infectious than a gram of field soil from a farm with a history of powdery scab. In a series of laboratory experiments, relatively high rates of disinfectants (five times the recommended rate) were needed to kill most powdery scab spores balls that were exposed for five minutes to a range of disinfectant groups. These groups included quaternary ammonium compounds, phenolic detergents, peroxygens, aldehydes and chlorine dioxide. Longer exposure times would allow rates to be reduced.

Relatively high rates of disinfectants were also needed to kill soft rotting bacteria in potato slurry coated onto wood or metal. Best practice in this case is to always wash surfaces before applying disinfectants. Many disinfectants are inactivated by organic matter and clay.

A set of guidelines on hygiene, cleaning and disinfection for potato farms will be released later this year.

Funded by Horticulture Australia on behalf of the potato industry and the Commonwealth Government. The project started in July 1998.

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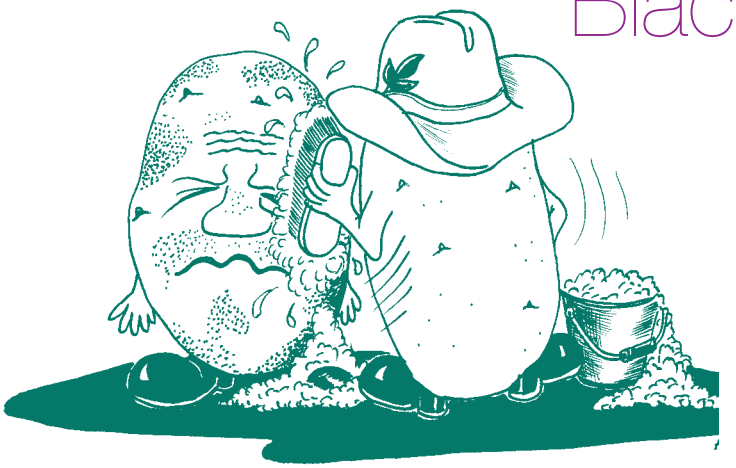
Controlling

Black dot in potatoes



The aim of this research is to develop management strategies to improve control of black dot disease for washed potato growers and seed growers.

Over the past 20 years, black dot fungus has been reported throughout the main potato production areas of the world, including Australia. However, the importance of the disease has been overlooked due to:

- leaf symptoms developing late in the season and being confused with normal dying off (or senescence)
- symptoms being similar to those of other diseases and in some cases, the fungus occurs in combination with verticillium wilt, *Fusarium* wilt, *Rhizoctonia* and silver scurf
- yield losses occurring in the absence of symptoms.

Previous work in Australia showed infection with Black dot reduced yields by 12% and US work has found it reduced yields by more than 5t/ha.

Fig 1: External symptoms of Black dot

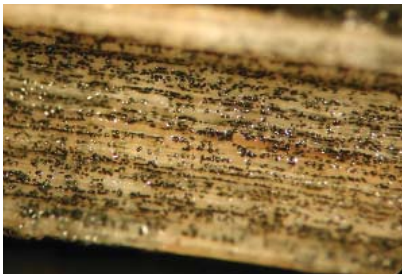


Fig 2: Internal stem colonisation by Black dot

Symptoms of black dot

Many growers are unaware of the potential yield losses, but recognise the skin blemish caused by the Black dot fungus. Plants affected by black dot display yellowing and wilting of foliage in the tops of plants in mid to late summer

As the disease progresses, infected plants turn brown and die. Numerous small (0.5mm) black dots (which are sclerotia, or dormant fungal masses) develop externally and internally on aging and dead plant tissue. (Fig. 1-2)

Plant death is accelerated where plants are already infected with Verticillium wilt (early dying) and *Erwinia* (black leg). Infected tubers, particularly washed tubers, exhibit brown greyish blemish on the surface that resemble silver scurf. (Fig. 3)

Black dot may also infect the foliage, especially when tissue is injured by windblown sand. (Fig.4)

Disease cycle

Infected seed tubers are the primary means of spreading the disease into new fields. Once established, the sclerotia survive on infected plant residue in the soil for up to five years.

Potatoes planted into infested soil are then exposed to the fungus, which invades underground plant tissue and moves upward in the plant. In late stages of disease development, new sclerotia are produced and the fungus population builds to a high level in the soil.

The fungus also attacks other vegetables such as tomato, cucumber, pepper, and weed species such as fat Hen and silverleaf nightshade.

Infection and spread

Seed: Black dot is primarily introduced into soil by infected seed pieces or tubers, but may also be transported on infected soil contaminating plant or machinery.

Field: Losses in yield and quality (blemishes and dry matter content) of tubers result from the destruction of conductive tissue in stems, roots and stolons, which reduces the number of large tubers and total weight of tubers harvested. Black dot infection is often associated with sandy or coarse textured soils, with the severity of infection related to the soil environment and fungus level in the soil.

Fig 3 Shrinkage of tuber skin

Fig 4 Black dot stem lesions

Black dot attacks aged, injured and/or stressed plants. Stress may occur through poor drainage and soil aeration, high soil temperature, low soil moisture (less than 65% available moisture), high air temperature, drought or low fertility. Black dot readily attacks plants whose petiole nitrogen and phosphorus levels are 4000 to 5000ppm below recommended levels. It also invades plants weakened by other diseases and is often found in association with these diseases.

Storage: Tuber infection is usually superficial, but can become significant in seed stock and during storage. Tuber discolouration, resembling silver scurf, is more noticeable on white skin varieties such as *Coliban*. Overseas studies have shown greater shrinkage in storage occurs in black dot infected tubers than non-infected ones. The amount of shrinkage increases with infection severity. (Fig. 5)

These studies also showed that greater tuber shrinkage occurs when stored at a relative humidity below 90%. In addition, shrinkage increased when temperature was raised from 4.5°C to 15.5°C in unwashed lots. Black dot develops and spreads well in storage at 10°C, which is the temperature commonly used for storing chipping cultivars.

Control Measures

Seed	Use certified seed from well established seed growers. Examine seed in the field or in storage before purchase.
Field	Rotations of five years before replanting potatoes on infested ground. Control other solanaceous crops and weeds that host Black dot. Fields should be clean of debris where Black dot can overwinter. Avoid excess watering, especially in low spots or poorly drained soils. Windbreaks may be useful on sandy soils and high wind areas. Avoid skinning or bruising tubers at harvest.
Storage	Keep relative humidity at or above 90%. If possible, store at 4.5°C. If the field was infected, wash tubers going into storage and use good sanitary practices.

Summary of trials to date

A survey of certified seed used in South Australia has shown that while some certified seed lots can be free of Black dot, a large proportion had a high incidence of the disease.

Percentage of seed lots infected with Black dot

1996-97	1997-98	2001-02
65	81	61

Trials are underway to evaluate the effects of planting infected seed on yield and quality, and to investigate effectiveness of various fungicides applied as seed or soil treatments along with soil fumigants Metham® and Telone®.

Preliminary studies over the past 6 months have shown that Maxim® (Fludioxonil) applied as a seed treatment reduces the incidence of Black dot on daughter tubers.

Future reports will include results of:

- fungicide seed treatments or soil treatments
- efficacy of soil fumigants
- survey of weed plants that may host Black dot.

Funded by Horticulture Australia on behalf of the potato industry and the Commonwealth Government.
Project started September 2001.

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Know your enemy - rotation trials help unravel the Rhizoctonia story

Conventional wisdom has been that a good break from potatoes, say four or five years, and a seed treatment would keep the *Rhizoctonia* problems to a minimum. We now know it's not that simple.

We suspect that the fungus has been surviving without its potato host in the rotation and are now just beginning to understand why.

There are several different groups or strains of the fungus *Rhizoctonia* solani called anastomosis (AG) groups. Each has preferred hosts, although they may also be found in 'non-host' crops. Of the 13 different groups identified, six have been associated with potatoes. The best known of these, the AG3 group, is usually reported as the main cause of *Rhizoctonia* damage in potato fields and is known as the 'potato strain'. It attacks potato sprouts, stems and stolons and also produces sclerotia, the 'black scurf', on potato tubers.

In a study at Virginia in South Australia in the early 90s, AG3 was found to be the predominant strain present in potato crops there. However, while studying crop rotations in the Central Highlands area of Victoria, we were surprised to find not only AG3 but also a high proportion of AG2 in potato crops. This group is pathogenic to brassica crops, some legumes, sugar beet and weeds such as fat hen causing hypocotyl rot (lower stem) of seedlings and typical *Rhizoctonia* 'wirestem' symptoms. It was never suspected of damaging potatoes but our tests showed that it was quite aggressive and could damage potato stems in the same way as AG3. Unlike AG3, however, this group does not produce many sclerotia (black scurf) on tubers.

Our studies also showed that the AG3 group, the potato strain, is able to grow and reproduce on root systems of brassicas such as fodder rape and Indian mustard and on fodder legumes such as red clover. The survival of the AG2 group probably depends on the presence of fodder legumes (clovers) and brassicas (fodder rape) that are common in many of the potato production systems in Victoria.

Rhizoctonia patch (AG3) in a young crop

Rhizoctonia stem and stolon canker

Sclerotia (black lumps) of the potato strain Rhizoctonia AG3 on the roots of a fodder brassica.

Managing Rotations – the clue to control

All this points to the fact that the management of *Rhizoctonia* will depend to a large degree on how we manage rotations. We need to understand the relative importance of the AG groups in the potato crops, what crops do the different groups prefer and how do the various rotation crops affect the livelihood of the fungus in the absence of the potato.

Some of these issues are the subject of new Horticulture Australia projects. Diagnostic tests that will allow us to quickly and reliably detect, quantify and track the different *Rhizoctonia* groups in the soil are being developed. Pasture is a vital component of many potato cropping operations and understanding the role of pasture in the lifecycle of *Rhizoctonia* and other pathogens and better managing pasture for *Rhizoctonia* control are the subjects of another project.

Know your enemy

The key to solving the frustrating problem of diseases caused by the soil borne pathogens is to know your enemy. We came to realise early on in the project on crop rotation how little we really knew about the soil pathogens such as *Rhizoctonia* and how they interact with their hosts and environment. This is because we focused on control strategies without really understanding the problem and this approach can be hit or miss. Without an understanding of the organism, we cannot develop reliable control strategies. The work on rotations provided the opportunity to learn more about *Rhizoctonia*.

Devastation of a potato crop caused by Rhizoctonia AG2

The fungus

Rhizoctonia inhabits soil where it grows as fine threads spreading out from organic debris and from sclerotia and onto the underground parts of plants in the paddock. The fungus can coexist with its hosts, including potato plants, without necessarily causing disease. It can be spread from paddock to paddock by planting seed potatoes with sclerotia.

Protecting a crop from canker and black scurf was once thought to be straightforward. Recommendations for management included practicing good crop rotations (potatoes one in every five years), using clean seed, treating seed with an appropriate fungicide and planting it relatively shallow into a well-prepared and warm seedbed. Once the plant had emerged from the soil, it was considered to be relatively resistant to attack by *Rhizoctonia*. Harvesting tubers as soon as possible at the end of the season was also recommended to avoid serious black scurf problems.

However, there are many instances where, despite good rotations and taking all precautions, farmers have problems with the disease, even in ground that has not produced potatoes before. Often there is no clear relationship between canker incidence on plants and incidence of progeny tubers with black scurf. It is clear the problem is more complex than was once thought.

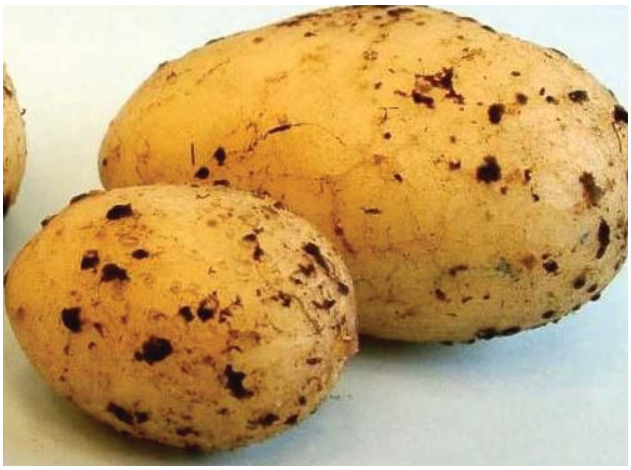
Groups or strains of *Rhizoctonia*

To better understand the relationship between *Rhizoctonia* and its hosts, the fungus was tracked on various crop species grown before potatoes and in the potato crops themselves in various field trials around Victoria. The rotation crops included fodder rapes, Indian mustard, red clover, perennial ryegrass and potatoes. Nearly 300 samples of the fungus were collected and identified.

The relationship between *Rhizoctonia* groups found in potatoes in Australia and different crop species

Rhizoctonia **group**	**Potatoes**	**Brassicas** (Fodder rape,Indian mustard)	**Red Clover**	**Perennial Ryegrass**
AG3 potatoes	Stem & stolon canker Abundant Sclerotia on tubers	Sclerotia on roots	Sclerotia on roots	Unknown
AG2 brassicas, legumes, sugar beet, fathen	Stem & stolon canker Occasional sclerotia on tubers Dry rot of tubers *Rhizoctonia* wilt	Hypocotyl (lower stem) rot of seedlings & wirestem	Hypocotyl rot & crown rot	Unknown
AG4 Sugar beet, soy bean, peanuts, chickory	Stem & stolon canker Feeder root damage No sclerotia	Hypocotyl rot & wirestem	Unknown	Unknown
AG5 Potato	Stem & stolon canker Moderate numbers of sclerotia on tubers	Unknown	Unknown	Unknown

Know your enemy - rotation trials help unravel the Rhizoctonia story (continued)



Rhizoctonia black scurf (sclerotia)

Damage to tubers caused by Rhizoctonia AG2

To our surprise, only about 50% of the samples taken from canker lesions on potatoes belonged to the AG3 group; most others, apart from a few AG4 and AG5, belonged to the AG2 group. When looking at tubers, the story was a little different. About 75% of the sclerotia tested from tubers belonged to the AG3 group and only 25% to the AG2 group.

What was just as surprising was finding sclerotia of the potato strain AG3 on the roots of fodder brassicas and Indian mustard in our trial plots, just like on potato tubers. The main roots of mature brassica plants are large, providing a good location for formation of sclerotia. AG2s were also found on the roots of these brassicas. Both AG3s and AG2s were found on the roots and crowns of clover. However, neither group have been easy to find on the roots of grasses in the field.

In glasshouse tests, the AG2s, the brassica/legume strains, caused hypocotyl rot and wirestem symptoms on red clover plants, various fodder brassica cultivars and on Indian mustard. The AG3s, however, the potato strains, did not damage these plants but produced abundant sclerotia on their roots. Neither the AG3s nor the AG2s damaged the roots or crowns of grasses but sometimes produced sclerotia.

A new *Rhizoctonia* disease of potatoes

Fast growing AG2s were also identified as the most likely cause of a new *Rhizoctonia* disease of potato crops observed over the summers of 1998/99, 1999/2000 and 2000/2001 when the disease showed up during prolonged spells of exceptionally hot, windy weather. The fungus caused lesions that girdled the stems at the soil-line, like 'wire-stem' Symptoms included rapid wilting and death of large patches of potato plants. This disease occurred later in life of the crop (after canopy closure) than the more typical sprout and stem damage found in younger crops.

The project was conducted with Trevor Wicks and Robin Harding at the South Australian Research and Development Institute, South Australia.

Funded by Horticulture Australia on behalf of the potato industry and the Commonwealth Government.
Project started in July 1996.

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Your Levy @ Work

National
PCN Management Strategy

A nationally agreed strategy to manage PCN in Australia is being developed in this project and includes sections on:

- **managing a PCN outbreak**
- **managing PCN infested land**
- **PCN Hygiene strategy**
- **market access protocols**

A draft plan was considered at a workshop in May 2002 attended by more than 30 industry and government representatives involved in quarantine, regulation and policy. It was proposed that key issues discussed at the workshop be resolved and endorsed by industry and government sectors.

These issues ranged from interstate trade anomalies, area and property freedom, state regulatory differences, compensation and incentives for reporting an outbreak to adequacy of current quarantine processes, social implications for people involved in outbreaks, overseas experiences and management protocols, and the role of certified seed and potato hygiene.

In particular, the project team is further developing concepts of property and area freedom for PCN in a final draft plan. Detailed proposals on survey and sampling protocols to demonstrate PCN freedom are also being incorporated.

Funded by Horticulture Australia on behalf of the potato industry and the Commonwealth Government. Project started in 2001.

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Your Levy @ Work

Prediction and molecular detection of
soilborne pathogens of potato

New soil tests are being developed for major potato diseases such as *Rhizocotonia* (stem canker and black scurf), powdery scab and common scab which give a measure of disease risk in a paddock. The tests are based on DNA probes and will accurately identify and measure disease organisms in soil and will ultimately be linked with disease prediction and better disease management.

Collaboration between the Department of Natural Resources and Environment and a research team at the Southern Crop Protection and Food Research Centre in Ontario, Canada has proven invaluable to this project. The team has developed rapid diagnostic tests for the common scab organism in soil.

In Canadian trials last season, levels of common scab in soil measured with these tests closely matched the subsequent levels of common scab in the potato crop. These tests are now being used as a model for developing soil tests for different diseases under Australian conditions. The outcomes of trials in 19 sites around Victoria to relate soil tests results with common scab levels in the crop are currently being assessed. Similar tests are also being developed for *Rhizoctonia* and powdery scab.

This is a three year project funded by Horticulture Australia on behalf of the potato industry, Department of Natural Resources and Environment - Victoria, Commonwealth Government and C-Quentec. Project started 2002.

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World Potato Congress – China

The Fifth World Potato Congress is to be held in Kunming, China from 20 to 25 April, 2003.

The Congress will bring together and provide information to potato growers, researchers, processors, traders, suppliers of machinery, equipment and services and other industry people, including Government representatives. This gathering of people from around the world provides an opportunity to discuss and exchange information on a wide range of potato related issues.

Growers and industry people who may have an interest in attending this congress are invited to register such interest with

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Tomato Spotted Wilt Virus – understanding the epidemics

Understanding viral epidemics and being able to predict and manage them will help with future control options

Tomato spotted wilt virus (TSWV) is exclusively spread by thrips. It has a wide host range including annual and perennial crop and weed species that act as reservoirs for the virus. This means the virus can appear sporadically in an area and persist even when potatoes are not present and therefore be a threat to future crops.

This project aims to understand the spread of TSWV in potatoes and develop a model for predicting and managing the epidemics.

A number of factors are thought to contribute to the rapid development and spread of TSWV in potatoes. These include:

The source of the virus

- planting seed potatoes carrying TSWV infection
- weed host reservoirs of the virus
- management practices such as cropping patterns and rotations (planting of susceptible crops nearby potatoes) and weed control

The susceptibility of the host

- planting susceptible potato cultivars
- planting date (and subsequent crop growth stage during major thrips flights)

Foliar symptoms associated with TSWV infection in cv. Shepody

The prevalence of virus vectors and conducive environmental conditions

- presence of thrips that can spread the virus
- favourable seasonal weather factors such as warm temperature, high relative humidity (both which influence thrips reproduction prior to and during cropping season), wind speed and direction (which will influence thrips movement into potato crops).

Surveys

Detailed surveys of potential risk factors were conducted on potato crops during winter and spring 2001 and the entire 2001-02 growing season in four potato ware crops in eastern South Australia (near Penola), two others in Victoria (Ballarat) and 41 seed crops in Tasmania. Risk factors considered were seed health, virus sources, thrips species that could spread the virus and their activity, virus levels and patterns of infection in crops over time, weather and potato plant resistance to TSWV infection.

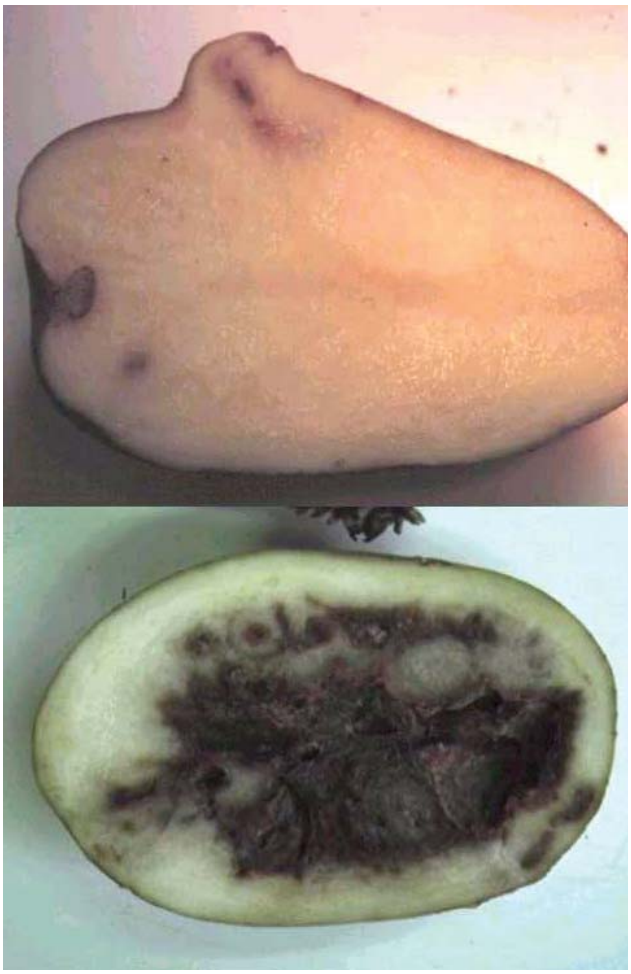
Survey results indicated TSWV was common in some potato seed planted in South Australia and subsequently in mid to late season samples of varieties *Shepody*, *Kennebec* and *Russet Burbank*. In Tasmania it was infrequently found in seed tubers before planting and in leaves mid to late season. TSWV was not detected in weeds and potato seed tubers from Victoria.

In field surveys several thrips species were trapped in potato fields and adjacent areas using yellow sticky traps. Only onion thrips (*Thrips tabaci*) and tomato thrips (*Frankliniella schultzei*) have been shown to spread TSWV, with onion thrips being the major cause of epidemics in Tasmania. Populations of most thrips species peak in the early summer months coinciding with early crop growth and posing a potential threat to the crop.

Western flower thrips - WFT (*Frankliniella occidentalis*), which efficiently carries this virus in other vegetable and ornamental crops, is not readily found in potato crops and is not currently considered a major threat to potato producers.

Resistance

Potato cultivars exhibited marked differences in their susceptibility to infection. While efficient foliar infection rate is a useful indicator of performance, it does not necessarily mean more infected tubers (which is the critical factor for seed producers). The transfer rate of virus from foliage to tubers is currently under analysis.



Tuber symptoms associated with TSWV infection in Russet Burbank (top) and Shepody (bottom).

In a glasshouse trial, *Atlantic* showed the highest resistance to foliar infection, but had very efficient transfer of virus from shoot to tubers. *Kennebec* and *Nooksack* also showed good resistance to virus infection, while *Shepody*, *Ranger Russet*, *Russet Burbank* had moderate resistance (*Russet Burbank* showed marked resistance to transfer of virus to tubers). *Royal Blue, Bismark* and *Pink Eye* were most susceptible to foliar infection.

Under field conditions, *Royal Blue* was highly susceptible to thrips feeding damage, while *Bismark* had remarkably high thrips resistance levels, with the other varieties falling in between. This is in direct contrast to the high susceptibility of *Bismark* to the virus. The mode of this resistance is currently unknown and warrants investigation, but surface features such as plant hairs may play a role. Further work to clarify and confirm levels of resistance to foliar and tuber infection are underway.

TSWV was only detected in weeds in South Australia. The weeds found with the virus included marsh mallow (*Malva parviflora*), capeweed (*Arctotheca calendula*) and hare's foot clover (*Trifolium arvense*) during winter and blackberry nightshade (*Solanum nigrum*), fat hen (*Chenopodium album*), wild melon/bitter melon (*Citrullus lanatus*), wireweed (*Polygonum aviculare*) and prickly sowthistle (*Sonchus asper*) at the end of the season.

Forty three percent of the weed fat hen that was tested contained the virus, which was higher than for the other weeds. Although these weeds behave as annuals, they were widely distributed in areas surveyed, suggesting they may be a reservoir for the disease that will carry it over from one season to another.

No TSWV was detected in weeds within the crop during the growing season. This is thought to be largely due to the application of pre-planting herbicides, a management practice that effectively destroys all viral weed sources before planting.

To achieve the disease levels experienced at the end of 2001-02 season, weeds outside the crop and plants emerging from infected potato seed tubers acted as the only potential virus sources. From these sources thrips could transmit the virus to crop potato plants and weeds during the season.

Weather information was collected to help determine other risk factors such as presence of host weeds and their relationship to the breeding of thrips. Preliminary indications suggest that humidity 1-2 months before appearance of TSWV symptoms may play a role probably in encouraging thrips larvae developing and acquiring the virus.

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Management strategies for soil insect pests

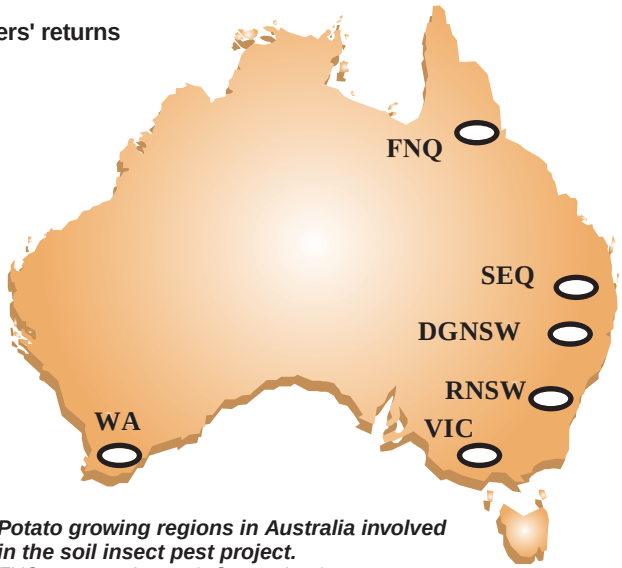
Soil borne insect pests of potatoes are a direct threat to growers' returns with their effect on tuber quality and yield.

This group of pests presents a special challenge to potato growers to protect their crops and, for seed potato growers, to reduce the risk of transferring soil insect pests to uninfested farms.

A three year project aims to:

1. Develop pre-crop sampling tools to determine whether there is a need to take action to protect crops from soil insect pests.
2. Build confidence in current control methods through better understanding of the insect pest situation in the soil.
3. Investigate new management options.

One of the outcomes of the project will be a kit to help farmers identify soil insects and encourage greater use of pre-crop soil sampling in determining soil treatments.



Potato growing regions in Australia involved in the soil insect pest project.

FNQ = far north Queensland
SEQ = south east Queensland
DGNSW = Dorrigo, Guyra in New South Wales
RNSW = Robertson in New South Wales
VIC = mainly the southern Victoria potato growing regions
WA = south west WA

National approach

Researchers in four states and across six potato growing regions are cooperating to target the insect pests of greatest concern to growers.

Some early results

In Western Australia preliminary investigations have helped estimate the risk of crop damage from whitefringed weevil. Growers have cooperated by leaving small areas of crop untreated, to verify the potential for crop damage for different numbers of weevil larvae.

Researchers assessing subsequent tuber damage have found that relatively small numbers of around 5 whitefringed weevil larvae per square meter can cause economic damage.

In contrast to the Western Australian results, early signs from New South Wales suggest that low to moderate populations of whitefringed weevil larvae may not lead to such high levels of tuber damage. This could reflect differences in larval development or environmental conditions between the two regions.

Soil pests of greatest importance in Australian potato growing regions

Region	African black beetle	Crickets	Pasture cockchafers (red & yellow)	Rice root aphid	White fringed weevil	White grubs	Wireworms
Far North Qld					✓	✓	
South east Qld		✓		✓	✓		✓
Guyra					✓		
Dorrigo	✓						
Robertson					✓		
Southern Vic			✓		✓		✓
South west WA	✓				✓		

Entomology Technical Officer Shane Trainer searching for soil insects prior to a paddock being planted to potatoes.

The abundance and in some cases, the distribution of other soil insects before and in one case after planting, have given similar encouraging results. In these cases, the absence of African black beetle has been reflected in sub-economic levels of tuber damage at harvest. The high abundance of false wireworm in a growing crop resulted in no tuber damage.

Studies into whitegrubs, field crickets, potato wireworm and rice root aphid are due to start this year.

Sampling for pest insects

Researchers will be determining the reliability of different sampling methods in predicting pest risk. Sampling tools include spades for soil borne larvae, baits for wireworm and crickets, pitfall traps and light traps for adult stages and root examination for rice root aphid.

Sampling for whitefringed weevil larvae, for example, involves searching the soil with a spade before planting to determine their abundance. If a 20 cm wide spade is used and an average of one larva per hole is found, the abundance of the insect is estimated at 25 per square metre.

Grower cooperation

Growers are integral to this project, providing sampling sites and opportunities for field days to share knowledge. We welcome growers contacting us regarding their experiences with soil insect pests and to be involved with the research.

Funded by Horticulture Australia on behalf of the potato and vegetable industries and the Commonwealth Government. Project started July 2001.

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In collaboration with
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Sandra Lanz (Lanz Agricultural Consulting NSW),
Stef De Faveri, Ross Storey, Dr Harry Fay and
John Duff (QDPI), and Associate Professor
Robert Spooner-Hart (University of Western Sydney)

Rhizoctonia seed piece treatments – are they useful?

Conducting your own trials on farm may be the best way to test whether a particular seed treatment works for you.

One of the prescriptions for managing *Rhizoctonia* canker and black scurf in potatoes is to apply a registered seed treatment before or at planting time. If there is no obvious *Rhizoctonia* damage in the subsequent crop, we assume, rightly or wrongly, that the chemical has worked. However, if we still have a *Rhizoctonia* problem in the treated crop we might complain that the chemical was completely useless.

Field trials conducted over four seasons as part of this a Horticulture Australia project have provided an insight into the usefulness of seed treatments for *Rhizoctonia*.

The *Rhizoctonia* fungus, known as *Rhizoctonia solani*, can occur on the surface of potato tubers as a network of microscopic threads or hyphae and much larger clumps of hyphae, the brown-black lumps or sclerotia, known as the black scurf symptom. The sclerotia form on tubers at the end of the season when the fungus gets the signal from the dying potato plant that it is time to go into survival mode. The sclerotia are environmentally resistant and remain dormant when the soil environment is not favourable to the fungus.

When seed potatoes with black scurf are planted at the start of the season, the *Rhizoctonia* becomes active, growing over the tuber surface and onto emerging sprouts where it can cause cankers (tan-brown depressions which girdle the stems and stolons). The result is poor and patchy emergence and patches of stunted plants.

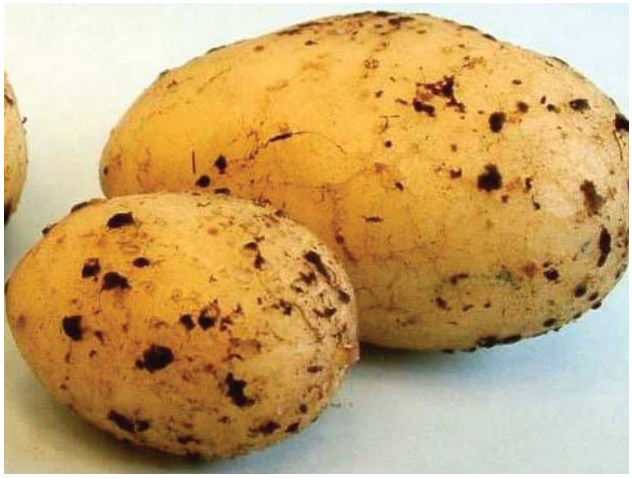
Seed piece treatments registered for *Rhizoctonia* control are meant to stop the fungus in its tracks and prevent its growth onto the stems and stolons. However, it is important to note that these protectant fungicides have little or no effect beyond the seed piece, except for treatments sprayed into the furrow.

How effective are seed treatments

In our field trials, whole seed tubers with obvious black scurf were treated with fungicides and planted in small plots in old ground with a history of potato production (volcanic clay loam near Ballarat, Victoria) and in new ground never planted to potatoes before (acid sandy loam near Colac, Victoria).

Several weeks after planting, the plants were checked for symptoms of stem and stolon canker, and at season end, progeny tubers were checked for black scurf symptoms.

Treatments included the registered fungicides Rizolex“ 100 D (100 g/kg tolclofos-methyl), Monceren“ 250 FS (250 g/L pencycuron), Rovral“ Liquid Fungicide (250 g/L iprodione) and Maxim“ 100 FS (100 g/L fludioxonil), applied just before or at planting as per label recommendations. Minitubers were planted in each trial as disease free controls to gauge disease levels from soil-borne *Rhizoctonia*.



***Rhizoctonia* black scurf (sclerotia) on potato tubers.**

Old ground

In old ground, the effectiveness of the treatments differed from season to season, between cultivars and even between different cultivars in the same season. In some trialsall treatments were ineffective. At best they resulted in about a 50% reduction in canker and black scurf in the progeny of treated tubers compared with untreated controls. There was no complete control. In one trial, treatments reduced canker and black scurf in *Russet Burbank* but not in *Sebago*. Notably, iprodione had no effect when other treatments provided some disease control perhaps because it could not be applied as rigorously as a commercial application on a small plot scale.

The results are perhaps not surprising since we know that *Rhizoctonia* also occurs in soil at the trial sites. Up to 40% of the minituber progeny developed black scurf in the trials and this can only come from *Rhizoctonia* in the soil. So, the sclerotia on the seed piece are not the only source of disease and , even if seed treatments control the fungus on the seed piece, they have little or no effect on the fungus in the soil surrounding the stem, stolons and progeny tubers. Any effect they have is overshadowed by the disease caused by the soil borne *Rhizoctonia*.

The relative abundance of *Rhizoctonia* on seed potatoes and in the soil, differences in susceptibility of different cultivars to the disease, differences in soil environments and seasonal differences all probably have something to do with seed treatment outcomes.

New ground

The story on new ground (acid sandy loam) was a little clearer. Tolclofos-methyl treatments reduced canker incidence by about 50% but had no effect on black scurf. The reason for this is not clear at this stage. In contrast, pencycuron and fludioxonil had little effect on canker incidence but did result in negligible levels of black scurf. This suggests that the *Rhizoctonia* affecting the tubers in this soil came from the seed piece. It does not explain why the treatments did not affect canker. It is possible that canker in this case is caused by a soil-borne *Rhizoctonia* but more work needs to be done to find out which groups or strains of the fungus live in these old pastures. As was the case in trials in old ground, iprodione had no effect on incidence of canker and black scurf in the trials on new ground.

Potato sprouts pruned by Rhizoctonia.

Conduct your own trials

Seed treatments clearly have some benefits, especially in new ground. However, the results are unpredictable, particularly in potato crops grown in traditional production areas with a history of *Rhizoctonia* canker and black scurf.

As a grower, what strategy should you adopt? The best approach is to conduct your own trials. This is not just the prerogative of scientists and is the only way you can decide whether seed treatments are cost-effective for you in the long run.

All of these treatments were registered because their potential to control *Rhizoctonia* canker and black scurf based was demonstrated in trials overseas and in Australia. However, in light of results presented here, the effectiveness of the treatments on your farm cannot be taken for granted because each scenario (soil type, season, fungal populations and cultivar) is different.

The strategy is to treat different batches of seed potatoes with each fungicide treatment. Then plant the treated seed in strips down the paddock alongside rows of untreated potatoes. It is best to repeat each treatment in the paddock, preferably three strips for each different treatment in different parts of the paddock. Clearly mark the treated and untreated rows so you can check for signs of disease as the crop emerges and grows and on tubers at harvest, thereby making meaningful comparisons on the effectiveness of different treatments on your farm. You may need to try this for a number of seasons to get a good feel for the best-treatment.

Funded by Horticulture Australia on behalf of the potato industry and the Commonwealth Government. Project started in July 1997.

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Your Levy @ Work

Understanding the implications of pasture on the management of soil-borne diseases of potatoes in Australia.

This project is investigating the effectiveness of pastures as a disease "break" for potato crops. Potatoes are commonly grown after a pasture phase of anywhere from two years or more. The pastures are an important part of many potato farming enterprises. There is evidence that, instead of breaking the disease cycle, pastures may in fact be acting as a "reservoir" for the soil-borne organisms that cause diseases such as *Rhizoctonia* canker and black scurf, powdery and common scab and pink rot. We need to determine whether the pasture species (fodder legumes and grasses) are hosts of the potato pathogens and how to best manage pastures to keep pathogen populations at a minimum.

As part of this work, a field trial was established with different rotations of grass-potato and clover-potato to track changes in pathogen populations and disease with these pasture components.

Some rotations include crops such as fodder brassicas and cereals. Cereals are said to be a good break crop for potato pathogens but we need to substantiate this claim.

Significant levels of *Rhizoctonia* canker (35% of plants) and the common tuber diseases were recorded in this season's potato plots. *Rhizoctonia* canker was also prevelant in volunteer potatoes in the various pasture plots. Abundant sclerotia (like the 'black scurf' on potato tubers) of *Rhizoctonia* solani were found on the roots of about 11% of the clover plant roots sampled from plots that will be sown to potatoes in the coming season. However, no sclerotia were found on grass roots, although hyphal threads of the fungus were found growing amongst the roots. Soil samples from the different plots are being tested for the powdery scab pathogen.

Funded by Horticulture Australia on behalf of the potato industry and the Commonwealth Government.
Project started in 1996.

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Your Levy @ Work

Increasing the opportunities for use of organic wastes in the Tasmanian vegetable industry

Mature compost is not waste – it is a potentially valuable input to agricultural production systems. In Tasmania about 250,000 tonnes of organic waste (or organic residuals) is produced each year, much of which has the potential to be recycled as soil conditioners and other inputs for agriculture, particularly vegetable production.

This project looked at some barriers to more widespread use of recycled organic materials in Tasmania. A significant outcome has been a database of information on the availability of organic residuals suitable for reuse in agriculture. The information is available on the Tasmanian Waste Exchange website - www.dpiwe.tas.gov.au/env/waste_exchange/.

Quality issues are at the forefront of many people's concerns with regard to using recycled organic materials in vegetable production, particularly in the fresh sector. These issues were reviewed in the context of QA schemes and food safety.

An Excel-based computer model has also been developed to help growers assess the relative economics of organic recycling operations, ranging from small on-farm facilities to large, centralised operations. The model shows that the costs of producing compost or similar products is quite variable, and depends on size of the operation, overhead costs compared to throughput, and transport distance to end users. The economic model is available on the Tasmanian DPIWE website (www.dpiwe.tas.gov.au).

Funded by Horticulture Australia on behalf of the vegetable and potato industries, Rural Industries R&D Corporation and the Commonwealth Government.
Project started October 2000.

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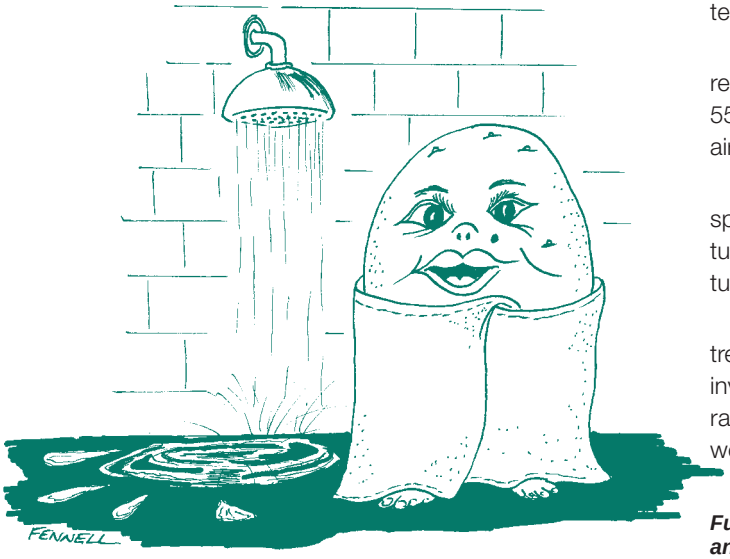
Managing bacterial breakdown in washed potatoes

Air drying washed potatoes for more than a minute with heated air at 45 – 55°C reduced soft rot. An air knife treatment, and ultraviolet and microwave radiation also successfully reduced rot.



This project evaluated different strategies to reduce soft rot caused by *Erwinia* bacteria in washed potatoes.

Soft rot is very difficult to control as washing tubers increases the likelihood of tuber decay developing.

Research to date on the conditions predisposing tubers to rot has found:

- the incidence and severity of soft rot is low in tubers collected directly from the field
- after contact with wash water, most tubers develop soft rot
- tubers develop rot mainly in the initial wash and tumbler regions of the washing plant
- high levels of *Erwinia* are found in wash water and recycled pond water
- low *Erwinia* levels in the initial wash and tumbler areas can be maintained by frequently renewing these areas with fresh water
- final rinse applications of chemical sanitisers do not reduce soft rot
- *Erwinia* in recycled water can be eliminated by reducing soil and organic matter then applying chemical sanitisers.

Soft rot develops as a result of a water film being maintained on a tubers' surface. The effect of air drying tubers was therefore investigated as a means of controlling soft rot. Air drying treatments were applied to inoculated tubers after washing and just before packing.

Treatments to evaluate air drying included air drying at room temperature, air drying with heated air and air knife.

Results showed that drying with room temperature did not reduce soft rot whereas air drying with heated air ranging from 45 – 55°C reduced soft rot. Tubers needed to be exposed to the heated air for one minute or more.

The other technique evaluated was the air knife, where high-speed air forced through a narrow 1mm slot suspended above the tubers is used to dry the tuber surface. Rotting was reduced when tubers were passed under one or two air knives.

Other methods such as ultraviolet and microwave radiation to treat infected tubers and UV light to treat recycled water are being investigated. Exposing tubers to either ultraviolet and microwave radiation for at least 30 seconds reduced tuber soft rot. Further work fine tuning these methods needs to be done.

Funded by Horticulture Australia on behalf of the potato industry and the Commonwealth Government. Project started July 1998.

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Morgan Air knife.

Your Levy @ Work

An agronomic and economic blueprint for a round seed system for Australia's potato processing industry

The aim of the project is to find the best way of producing round seed and then determine an equitable payment system for seed growers.

In the first season of trials in 1999-2000, whole (round) and cut sets were planted at a range of densities at two sites. Whole and cut sets produced similar total tuber yields. A similar situation occurred for round seed yield, except at one site where cut sets produced more round seed than whole sets. Round seed yield, on the other hand, was very sensitive to planting density with the highest yields being achieved at the highest planting density.

Field work was carried out in the 2000-01 season to confirm the previous year's findings. These compared cut and whole (round) seed tubers, planted at three selected densities. Half of the seed tubers were treated with the natural sprout suppressant Carvone during the storage period prior to cutting.

The Carvone was included to confirm earlier work carried out by Dr Philip Brown of the University of Tasmania, which suggested that such treatment enhanced the production of small, whole seed tubers in the ensuing seed crop.

Results reinforced the major effect planting density has on the production of whole seed and the similar effect of planting whole and cut sets on total and round seed yield.

While the positive effect of Carvone application on the production of whole tuber grades of progeny was significant, it was less than found by Dr Brown in his earlier work.

In his project, Dr Brown has concluded that seed source, mother crop husbandry, harvest and subsequent storage condition had a major effect on seed size distribution in the ensuing crop. These effects were greater than the effect of Carvone.

In 2001-02, whole and cuts sets were planted at three densities to further evaluate the effect of the previous generation production and density on producing small whole tubers. An analysis of the results and an economic evaluation are in progress.

Funded by Horticulture Australia on behalf of the vegetable and potato industries and the Commonwealth Government.

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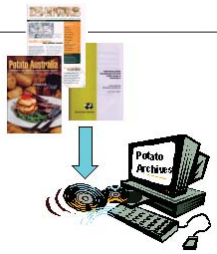
Making past industry information from R&D more accessible



Being able to gain access to the knowledge generated from our R&D program is important if the industry is to gain full value from its investment.

Work has been underway to collect, digitise and archive all the articles from past editions of Potato Australia and Eyes on Potatoes and Final Reports from Horticulture Australia funded research projects.

The final product will be a CDROM that can be easily searched to find all the relevant information produced by our R&D program. The archives will also be included in the new national internet service for the vegetable industries.

Converting publications into a digital form has proceeded smoothly.

Significant delays have been experienced in the project though as a result of the need to clarify copyright issues and reassess technology options for producing the archives.

Legal advice had to be obtained with regard to the introduction of amendments to the Copyright Act last year. As a result of this advice the design of the archives has been modified and a detailed copyright database constructed. This work is near complete.

The other challenge we have had has been the choice of technology to use to construct the archives. The original solution proposed has had to be re-assessed due to the enormous change in technology since the project methodology was first developed.

Identifying an approach that will not become redundant in a few years, is compatible with all the systems that it is likely to be used on, has the flexibility we need, takes into account legal considerations and is easy to update and maintain has been challenging.

The project is due to be completed by the end of the year.

Funded by Horticulture Australia on behalf of the potato industry and the Commonwealth Government. Project started March 2001.

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Latest R&D reports

Potato

The following is a list of Horticulture Australia Final Reports (i.e. except for AUSHORT) released in the last three months.

Enhanced metalaxyl breakdown and its implication in Australian horticulture	**VX00012**
Increasing the opportunities for use of organic wastes in the Tasmanian vegetable industry	**VX99002**

AUSHORT

The following is a list of AUSHORT Final Reports realised to date. These projects are funded by all horticultural industries with only a small amount coming from potatoes. They usually deal with issues that are common across many industries.

Addressing quality management and food safety issues in horticulture	**AH99007**
Advancing Horticulture's coordinated response to the existing chemical review program	**AH99002**
Coordinating Horticulture's response to Codex	**AH99014**
Horticultural Industry's Coordinated Response to the National Registration Authority's Existing Chemical Review Program, 1999	**AH98001**
Improved labelling of pesticides to encourage optimum use in horticultural crops	**AH99003**
Needs analysis of codex issues as they relate to horticulture	**AH99012**
Statistical scoping study for the Australian Horticultural Industries	**AH00026**

Reports are available from Horticulture Australia for $22.00 in Australia or $US30 outside Australia including postage. To obtain reports send a cheque or money order with a note quoting the project name/s and project number/s to:

The Publications Officer
Horticulture Australia
Level 1
50 Carrington Street
Sydney NSW 2000
(02) 8295 2300
Fax: (02) 8295 2399
publications@horticulture.com.au

Implementing the potato industry's Communication Plan

The Communication Plan provides our vision of what we want as an industry to improve communication and technology transfer.

Communicating research outcomes to an industry that is spread out over such a large continent is a real challenge. The services we are developing are a balance between user needs and what we can realistically afford and maintain with the resources we have at our disposal.

The following is a summary of our approach:

- *Potato Australia* – Our technical journal where all projects being funded by the Potato Levy are listed and reported on each year. A wide range of authors also submit items of interest to industry.
- *Eyes on Potatoes* – Our newsletter focuses on outcomes from research, information products being released, news, reports from our peak industry groups, review articles, what is happening in the states and farmers' experiences.
- Information Directory – A directory of technical contacts, products, services and information about our industry. An important reference guide.
- Potato Archives – The industry's library of outcomes from research and development. Rather than trying to keep track of a large number of publications the archives will provide a means of rapidly accessing what you want quickly and easily. Initially to be developed on a CDROM, later it will also be available on the internet.
- Internet site – The internet site will provide 24 hour a day seven day a week access to important industry information. It will also provide tools to make obtaining the information you want much easier. It fills a gap that cannot be addressed by the publications. The Potato Internet Starter Pak which provides links to potato internet sites across the planet will be incorporated into the new internet site.
- Books and management guides – These are information products that consolidate existing knowledge into tools useful to the industry. They maybe field guides, books, computer programs or any product that will make making a management decision easier on the farm or after it leaves the farm and before it reaches the consumer.
- Distribution system – Out goal is to work with industry groups to ensure the potato publications reach all potato levy payers and the service industry. The service industry also needs to be kept up to date if it is to provide a high quality service to growers.

Plans do change

A plan is not something you develop and stick in the cupboard. It needs to be looked at regularly to ensure targets are being met and updated to ensure ongoing relevance to the industry.

The Potato R&D Committee reviewed the Communication Plan last September and will do so each year.

Goal 1 – Raise awareness of industry issues

The Editorial team led by Cathy Sage has been working on improving the quality of Potato Australia and Eyes on Potatoes. A lot of effort has gone into editing, sourcing and presenting articles to make them more relevant and easier to read. Last year Potato Australia underwent a major facelift and next year Eyes on Potatoes will go full colour.

Going full colour with Eyes on Potatoes has several advantages. Pink rot will look like pink rot instead of green rot. There are many pictures that need to be in full colour if they are to be truly helpful to industry.

As colour printing has become cheaper the cost difference is not that much and for many advertisers it is easier to supply ads in colour than in black and white.

A proposed email service for providing industry updates has now been integrated into the new internet site.

QLD/NSW Smiths Crisping Group

Potato Internet Starter Pak

Version 4

If you want a copy of the Starter Pak send an email to Leigh Walters (lwalters@saff.com.au) and include in the subject box - **Request for Starter Pak**. In the area where you normally write your message type - Request. If you have Windows XP or on a network with a firewall put in XP instead of request.

Goal 2 – Improve access to industry information

The Information Directory has been undergoing major modification as a result of industry changes and was to be included with Potato Australia. Unfortunately with me going down with the flu and also having a few other hassles I did not expect, its release has been delayed until later in the year.

The national distribution system has been undergoing a major validation. This is part of the ongoing process of keeping it up to date to ensure all growers and the service industry receive their copies of Eyes on Potatoes and Potato Australia.

I would like to thank the distributors for the work they put in to get the publications out to everyone. Producing and distributing Eyes on Potatoes and Potato Australia is very much a team effort.

Once the remaining funding required for the internet service is secured the joint project between the potato and vegetable industries will commence. The potato industry has already collated most of the information required for the service and developed the computer systems required to support it. Other vegetable industries will be doing this task over the next two to three years.

In the meantime the Potato Internet Starter Pak has been updated and provides links to internet sites around the planet.

Potato Archives will also be part of the new internet service and this work is well underway and due to be completed by Christmas.

Goal 3 - Improve understanding of industry information

Consolidating industry information into books, guides and other information tools is important if people are to gain the full benefits of what has been done in the research and development program in Australia and overseas.

Research is done to answer questions and provide one more piece to the jigsaw puzzle. For any topic there are many pieces that are not always easy to put together. A book or guide can pull all these pieces together in a way that enables the reader to see the picture more easily.

Paul Horne, Rudolf de Boer and Denis Crawford have recently completed the first of a series of books and guides.

* Insect and diseases of Australian potato crops (Book)
* A field guide to insects and diseases of Australian potato crops

Goal 4 - Facilitate implementation of Communication Strategy

To provide technical information to industry from the potato research and development program a lot of work goes on in the background by many people.

In my role it is not possible to support everyone individually so I need to work with others to ensure we get the information out to those who need it. Government departments, processors, rural suppliers and consultants all play a critical role in helping farmers to effectively adopt new technology. Providing our technical advisers with the most up to date information is therefore critical to the technology transfer process.

Some farmers have asked why does the industry supply information (Potato Australia and Eyes on Potatoes) free of charge to non-levy payers. The answer is quite simple. If people providing technical information are kept up to date they can provide a better service to farmers, which ultimately leads to a better utilisation of the technology.

In providing advice, technical advisers will also utilise their own knowledge of local conditions and often add considerable value to the information from the R&D program.

Recently I have started moving around the country doing Communication Updates. These will provide information on new and coming communication products and how we can get the most from our levy funded research. The sessions are flexible so that the needs of participants can be met.

Sessions completed to date include one with Bundaberg growers in Queensland and another with the QLD/NSW Smiths Crisping Group in Brisbane. In Tasmania sessions have been held in Rocky Cape, Longford, Scottsdale and Devonport.

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Coordinating technology transfer in the Australian potato industry

The deadline for finalising this project has been extended to allow all the work to be completed on the Information Directory, the Code of Practice and evaluation of the project. Most of the work of this project now comes under *Implementing the potato industry's Communication Plan.*

The project aimed to improve adoption of technology from the R&D program, improve communication in the industry and develop a Code of Practice for Potato Cyst Nematode.

Code of Practice

A draft Code of Practice for Potato Cyst Nematode has been finalised and has now become part of the draft National PCN Management Plan. Further revision of the Code will be undertaken as part of the national plan, a project managed by Gordon Berg at the Institute for Horticultural Development at Knoxfield.

I would like to thank the growers, processors, packers, merchants and agribusiness and government advisers who commented on the draft and help shape it into a useful document. The comments from people during the course of the 27 interviews highlighted a range of issues that were used for the Code of Practice and will contribute to the development of a long term hygiene educational strategy through the national potato publications.

The interviews also reinforced in my mind the importance of broad consultation in developing strategies or products for industry and just how variable the situations people are facing in managing their businesses.

A computer based hygiene information system has also been developed in this project and will be tested and refined over the coming months.

Information Directory

Lots of delays unfortunately but it will be sent out by Christmas.

Evaluation

This will commence soon and will be the last task in the project.

Management Committee

Many levy funded projects have an industry Management Committee or Steering Group to support the Project Leader and ensure the project objectives are met. Their contribution often goes unnoticed and yet they are very important to the success of a project.

I have been lucky to have an excellent committee consisting of Wayne Cornish and Neil Perry from the Potato Growers of South Australia, Jim Kelly the Manager of Horticulture at the South Australian Farmers Federation and Barry Philp the Manager of Industry Development at Primary Industries and Resources South Australia.

Neil Perry, Jim Kelly, Wayne Cornish and Barry Philp

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ARAC

A Potato Agricultural Research and Advisory Committee (Potato ARAC) has been established in South Australia to identify research and development (R&D) priorities and review proposals for the South Australian potato industry.

ARACs have been operating successfully in Tasmania providing industry with greater opportunity to have a say in the R&D process. This model was used as the starting point for developing an ARAC system in South Australia for potatoes and vegetables.

How does it work

Each year growers, processors, packers/exporters technical advisers and other key industry players will be asked about what issues are important to them that may require research, development or extension. These issues will be collated and prioritised to form a list of industry priorities.

Research & Development providers will be notified of the priority issues with a request to put forward concept proposals for projects. Issues that fall outside the scope of research and development will be forwarded to the relevant group for consideration and action.

The Potato ARAC will review the concept development proposals using the industry priorities and notify R&D providers and external funding bodies such as Horticulture Australia of the projects they endorse.

A list of high priority issues not covered by the concept proposals will be circulated to R&D providers seeking proposals.

Timetable for issues to be progressed through Horticulture Australia

20th August 2002	Issues documents received
30th August 2002	ARAC Committees review issues papers
6th September 2002	Issues forwarded to R&D providers
15th October 2002	ARAC Review of concept proposals
14th November 2002	Concept proposals returned to authors
30th November 2002	Levy funded concept proposal submissions received by HAL

Who is on the committee

The Committee will be industry driven. Members on the inaugural Potato ARAC committee are: Terry Buckley (Farmer – Processing), Andrew Widdison (Farmer – Processing), Clinton Zerella (Farmer – Fresh), Neil Perry (Farmer – Fresh), Peter MacGill (Farmer – Seed), Paul Frost (Saffries – Processor), Basil Mondello (Farmer – Packer), Adrian Dahlenburg (SARDI – Research), Andrew Hayton (Wesfarmers – Consultant) and John Fennell (PIRSA - Chair).

Research and Extension Day

A Research and Extension Day will be held annually to allow industry to hear about the progress of the projects and provide input into the work.

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Evaluating the market for ware potatoes in South East Asia

Potato consumption in South East Asia is generally increasing as personal income increases and consumers become increasingly westernised.

However, exports of Australian ware potatoes to Hong Kong, Singapore and Malaysia have decreased from 10,800 tonnes in 1999/2000, to 8,600 tonnes in 2000/2001. This is entirely understandable given the substantial increase in the volumes consigned to the market from low cost producers such as China, South Asia (Bangladesh, India and Pakistan), the Netherlands and New Zealand.

In 2001, Hong Kong imported about 11,800 tonnes of fresh potatoes and Singapore some 31,400 tonnes. While Malaysia has no significant domestic potato production, import statistics reveal little, for fresh potato imports are included with "other roots and tubers". Malaysian statistics show that in 2001, only 5,500 tonnes were imported, although into both Singapore and Malaysia, imports from Indonesia are not reported. Similarly into Hong Kong, as trade with mainland China becomes more liberal, the statistics become increasingly less accurate. Caution must therefore be exercised in attempting to draw any meaningful conclusions about the size of the market from the import statistics.

"Budget" potatoes

The predominant market segment is the mainstream or budget potato. Potatoes falling into this market segment are sold either in the wet markets or the supermarkets.

In Hong Kong, China is the major supplier. Product from China is exceptionally cheap at only $HK1-2 per kg, of generally good quality and available all year round. Tubers are generally large (3-4 tuber per kg), elongated, with yellow skin and yellow flesh. With shipments arriving on a daily basis, very few problems are experienced with tuber decay.

Large, oval, yellow skin, yellow flesh potatoes from China. This product dominates the budget market segment.

In Singapore and Malaysia, the market is dominated by imports from Indonesia. The major variety (*Granola*) is available year-round and is well liked by consumers because it is tasty, versatile and keeps its shape when cooked. Indonesia is the closest supplier and importers find it easier to communicate with suppliers and coordinate deliveries in response to the market. However, potatoes from Indonesia are not always the most cost competitive.

During December to April, potatoes from The Netherlands are often cheaper. More recently, India and Pakistan have entered the market and from April to July, New Zealand is shipping increasing quantities of good quality *Granola* to the market at very competitive prices. These alternative suppliers are expanding their market share, helped by poor packaging and inconsistent grading of the Indonesian product. Indonesian tubers are not always adequately cleaned of soil, and there are often significant losses associated with infestation by tuber moth and bacterial wilt.

Currently, several importers are sourcing *Granola* from New Zealand. The quality of the tubers is vastly superior; tubers are larger, more uniform; there are fewer problems with tuber rotting; and the product is extremely cost competitive, arriving in the importers warehouse for the same price as the Indonesian product. Other than a slightly darker skin colour, the tubers are indistinguishable from the Indonesian product. However, since the market prefers Indonesian potatoes, product from New Zealand is being regraded, repacked and resold as Indonesian potatoes.

Although China supplies the market all year round, it was not until June-July that Chinese potatoes began to dominate the market. Into both Singapore and Malaysia, the product is generally consigned to the market in 10 kilogram cardboard cartons. The tubers are generally cleaner than those available from Indonesia and have a superior cosmetic appearance. The tubers are large, oblong, well graded and uniform, with an attractive gold skin and yellow flesh. However, the quality of the product consigned to the market often changes abruptly, depending upon the supplier.

The Netherlands is the best of the European suppliers. Product is more uniform and there are few problems with shipping. It is generally accepted that Dutch potatoes have the best reputation in the market, but it is apparent that it is not so much the country of origin that is important, but rather the variety. Both China and Indonesia often market their product as "Holland" potatoes.

Chinese potatoes in a small retail market

The North American Russet potatoes, market leader in the baked potato segment

Baking potatoes

This segment of the market is dominated by just one supplier (the USA) and one variety (*Russet Burbank*). Traders suggest that the US dominates this market because of their ability to precisely meet market demands for large elongated tubers. Product is consigned to the market in 50 pound cardboard cartons with a count of either 90 tubers per carton (255g per tuber) or 110 tubers per carton (205g per tuber).

Over many years, the US has been able to maintain a continuous supply of good quality product to the market, although in May-July, immediately prior to the start of the new harvest season, the quality may deteriorate. Prices also remain relatively constant all year round. However, it is apparent in both Malaysia and Singapore that the quality of the US potato is well below that considered suitable and importers are aggressively seeking alternative suppliers in Australia.

While product from China is generally very good, quality is highly variable depending on seasonality and the supplier

Premium washed potatoes

The most recent segment to emerge, this market caters primarily for the needs of the emerging middle class and expatriate population. For this segment, the market requires cosmetically attractive tubers. The skin should be smooth and unblemished, preferably yellow, with only a very small demand for red skinned tubers. Tubers should be round or oval, but with a regular consistent shape and uniformly graded (by size). Tubers may range in size from 80-100 g up to 200-250 g depending on the variety and individual buyer's preferences.

Australia is currently the major supplier to this segment. While this is the smallest market segment, high prices attract intense competition. Currently, there is little opportunity for further growth in this segment with most importers suggesting that this market segment is saturated.

The Cheung Sha Wan wholesale vegetable market in Hong Kong. With trucks arriving on a daily basis, this market distributes the product arriving from China.

Food service market

Here there are two clear subdivisions based primarily on tuber size. While most restaurants prefer large potatoes for baking or the preparation of French fries on the premises, others require the small baby potatoes.

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Making money out of potatoes – it is not difficult

Speakers at the National Potato Business and Marketing Conference in Mt Gambier in late August could only be described as excellent. I cannot remember a conference I have attended where there were so many presentations of such high quality.

The messages – there were many. Probably the most important was the need for the industry to work together to market potatoes more effectively. The opportunities are there, but we need to drive the change.

The low attendance by growers was a disappointment. Marketing is about making money so why are so few growers interested? It is a question that needs to be answered.

On behalf of the industry I would like to thank Malcolm Kentish, Jan McIntyre and their team in putting together a very memorable conference. Thanks also to the excellent support from sponsors and the hospitality of the Mt Gambier community.

Snippets

A conference tends to impact on people in different ways depending on their interests and understanding of the topics. The following are a few of the points I noted from the conference.

National Marketing & Promotion Program

Brian Newman's paper, *Current Marketing Strategies*, described efforts to generate funds to support the marketing of potatoes in Australia.

In 1997, AUSVEG put forward a plan for a $5 per tonne levy on fresh market potatoes. It would raise about $2.5 million annually, be managed by industry through Horticulture Australia and address four key areas:

- marketing and promotion
- product quality and consumer satisfaction
- packaging and presentation
- export market development

After extensive industry consultation and approval the plan was presented to Government in 1998 for the introduction of a Potato Marketing Levy.

Political action by some segments of the industry and a general lack of unity caused AUSVEG to withdraw the proposal in November 2000.

Present Situation

No national marketing and promotion program for potatoes.

Industry lacks resources to collectively address major issues:

- retain market share against competition
- address product quality issues
- understand and meet consumer wants and needs
- develop export market opportunities.

Professor Ron Voss, *University of California*

Setting the scene globally

A great summary of what has been happening around the world, especially the changes occurring in China.

When listening to a talk on what is happening in the world potato industry it would be easy to view the topic as having little relevance to the local situation. Ron then made a statement about a large shipment of fresh potatoes being brought into Australia from China. A pause – my heart missed a beat. He then said of course it is not true but what if it were?

The point was made! Australia is part of the world market.

Michael Brownlee, *Creative Dialogue*

Understanding today's consumer

Michael presented some of the findings from consumer research commissioned by Horticulture Australia. A full report will be included in December Eyes on Potatoes.

His favourite phrase was "follow the money". It was a simple reminder that marketing is not just supply and demand but working smarter to make a profit.

Brian Newman, *AUSVEG*

Current marketing strategies

Brian reminded us about some of the marketing fundamentals and summarised the industry's attempt to introduce a National Marketing & Promotion Program in 1997-98.

Helen Lipton, *Moraitis Fresh Packaging*

Supply chain management

Helen reinforced the outcomes of the Horticulture Australia consumer research which highlighted the changing habits of consumers. She also stressed the importance for industry to respond to these changes and the need to focus on quality.

Sherry Clewlow, *Nutrition Australia and Food Lovers Workshop*

The Potatolithic Diet – the role of potatoes in the modern menu

Nutrition can be a bit of a dry topic but not with Sherry talking about it. She reminded the audience of the nutritional value and versatility of the potato and how these were a marketing strength. Later in the workshop Sherry put into practice her culinary skills to cook up a range of potato delicacies.

Malcolm Kentish and Dorinda Hafner

Bob Gaussen, *Retail Grocery Industry Ombudsman*

Role of the Retail Grocery Industry Ombudsman

Bob's message was simple. Going to court to resolve problems is costly and time consuming. The Ombudsman offers a simpler solution by mediation for many problems. Bob's statement that most problems were resolved within two weeks makes you think twice!

Ron Gall, *NZ Vegetable & Potato Growers Association*

Potato innovation

Scooters, milk, water and square watermelons have a lot in common. If you want to know why you will need to read Ron's paper.

Murray Richardson, *Fresh Chain*

Electronic market and sales management

Electronic marketing will undoubtedly play a bigger role in potato businesses as we seek to become more efficient and look for new opportunities to market produce. Buying and selling produce through the internet is likely to become as common as using a mobile phone.

Using Fresh Chain struck me the same as any major change in business direction and Murray summed it up quite well – start off simple, engage your partners and let the benefits flow naturally. The basics of good business do not change just because you are on the internet!

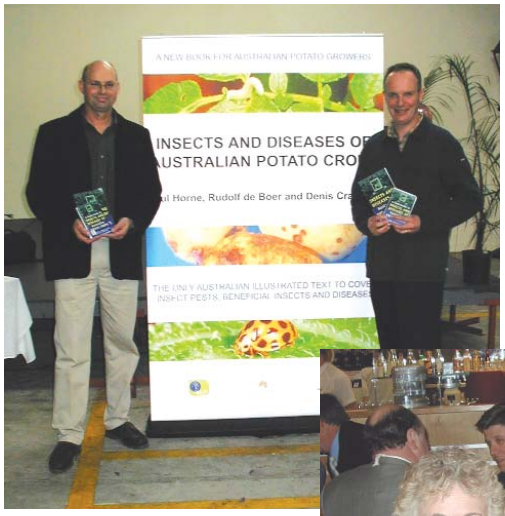
David Hanlon, *Resource Consulting Services*

Business planning and benchmarking

Training, employment and succession planning

David had some great one-liners such as – I do not believe you can do today's job with yesterday's tools and stay in business. The need to evolve with the world around us is an important part of doing business.

He also focused on the need to continually look at how we are doing business. We can all suffer from familiarity through slow progressive change and fail to recognise the need to change. He used an old frog experiment to reinforce the point. If you put a frog in cold water and bring it to the boil the frog will allow itself to be boiled to death. (Alternatively - if you drop a frog in boiling water it will immediately jump out.)



Dolf de Boer and Denis Crawford at the launch of their book and field guide

Helen and Ron Voss from California, USA

Lunch

Farmers Neil Perry (SA) and David Addison (TAS)

Panel Session

Roger Tyshing leading discussions with feloow Tasmanians John Rich, Phillip Beswick and Stuart Millwood

Sherry Clewlow

Snack time

Malcolm Kentish receives an award from Limestone Coast Tourism

Crookwell growers Amanda and Garry Kadwell talking to Matt Bennett, Agronomist with Zerella Holdings.

Deborah Perkins, *Rabobank Group*

How to make a profit every year

Deborah focused on the basics of business – something most of us need to be constantly reminded about. She also emphasised the need to focus on the opportunities, look at ways to be more efficient (eg. automate transactions) and not sacrifice our personal goals.

I think all of us need to be reminded of the need for balance in our lives and to not lose sight of what is really important as opposed to what is urgent in our day to day dealings.

Timothy Mellor, *Mellor Olsson*

Legal considerations

Timothy had some very good general precepts or rules:

- planning – if you plan for it, it will never happen
- agreements – a good contract is one that dies quietly in its sleep
- negotiations – a good settlement is one that everyone is a little bit unhappy with
- legal advice – good lawyers never go to court
- responsibility – "isn't this your signature?" READ THE CONTRACT

His concluding statements are also worth remembering -

Hospitals are full of people who didn't see their doctors early enough. The courts are full of people who didn't see their lawyers/professional advisors early enough!

Lawrie Mortimer, *Telstra*

Making the most of your telecommunications services

Telecommunications is one of those industries that evolve so quickly that most customers like me never really feel on top of things.

Lawrie did a good job of focusing on the relevant issues and highlighted the benefits of the CDMA system for growers. He stressed that if users are having problems with their internet speed to call 1800 427 457 for assistance. In not all instances is Telstra aware there is a problem until contacted.

Steve Chapple, *AusIndustry*

Innovation assistance

AusIndustry provides grants, tax concessions, duty rebates and information to Australian businesses. Steve indicated they were already assisting some potato companies. To better spell out what is available we'll include an article in the next edition of Eyes on Potatoes.

David Lawson, *AUSTRADE*

Identifying export opportunities and programs

Export is not for everyone but for those ready to seek overseas markets there is a lot of help available to get you started. David made one point that particularly stuck in my mind – you need to sort out your domestic business first.

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Developing strategic alliances to accelerate potato sales

Who is the competition? In today's marketplace, where thousands of producers and manufacturers are competing for the consumer share of stomach, who are we really competing against? Is it other growers? Is it other producers, or are we competing against products that take consumers away from fresh produce?

I think we are competing against products that take consumers away from fresh produce and the most powerful way to combat the competition is to work together to develop strategic alliances that keep consumers eating potatoes.

Making a powerful impact – benefits of generic promotion

Generic promotion is the ability to work together to grow the size of the business pie. Generic promotion recognises that your competitor is not your neighbour who is growing potatoes; it is manufactured products like pasta and rice. Generic promotion mandates that producers work together to grow the size of the market for potatoes as a category.

What are the benefits? They are numerous if you are open to seeing the possibility. Generic promotion enables an industry to work together to achieve objectives no one producer themselves could afford to achieve. For example, market research.

Let's say the potato industry wanted to explore what today's consumers are eating and where potatoes currently fit in today's diet. As an individual, no one grower/producer could afford to do this level of research. This is an ideal opportunity for the industry to work together, generically, to fund the research and share the results equitably among all producers. Together, the costs to each individual producer would be low and the results can benefit all. It is a perfect example of using generic promotion to grow the size of the potato pie.

When is generic promotion most suitable? The best way to determine whether generic promotion is suitable is to ask the question, "Who would benefit?" If the industry and all individual growers/producers would benefit, then the activity is probably best suited for generic promotion. If there is an issue that impacts the entire industry, for example – consumer perception of potatoes, then it is an ideal candidate for generic promotion.

Because fresh produce is not like grocery and branding plays a much smaller role, growers/producers can often benefit from generic promotion. To make it happen however, growers/producers must collaborate. Which leads us to the next key point.

Creating effective marketing strategies through collaboration

As we mentioned above, working together or working collaboratively, growers/producers can achieve significant objectives in terms of growing the size of the 'potato pie.' This has significant benefits to all growers/producers. Let me explain by using a hypothetical case study for potatoes.

Let's assume that as an industry, you want to have a better understanding of what consumers think about potatoes and where potatoes fit in today's Australian diet. You also want to understand what products compete with potatoes – if people aren't eating potatoes, what are they eating. So as an industry, you decide to work together to collaboratively fund market research.

What you will find, when the research results are revealed, is that there are common issues consumers have with potatoes that every grower/producer shares. This might be issues with how to use potatoes. It might be issues with how potatoes rank nutritionally. It might be issues/frustrations with potatoes turning green. There will be issues that relate to the industry – as opposed to any one producer. And, you will also find, that this issue is probably impacting a shopper's desire to buy potatoes.

The key is to understand that most consumer issues are not a result of one supplier supplying a retail chain. The issues are usually bigger and deal with consumer's perception of or use of potatoes as a category, not as an individual product.

This is where collaborative marketing enters the picture. Because consumer issues are usually bigger issues, no one producer can afford to address the issue. However as an industry, if you don't address the issue, you will continue to watch potatoes share of stomach shrink. The industry, collectively and collaboratively, is in the best position to address the issue on behalf of the industry and ensure potatoes share of stomach (for all producers) is maintained.

Summary

As growers/producers, it is so important that you realise your competition is not your neighbour who is growing potatoes, it is all the other products that compete with potatoes for the consumers' share of stomach. As an industry, the most powerful way to combat the competition is by working together to understand the issues that stop shoppers from buying potatoes – then work together to develop strategies that address the issues.

It is all about collaboration and developing strategic alliances with each other to grow the category for potatoes.

Edited from a presentation by Lisa Cork, The Marketing Department Ltd
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Potato Innovation

Ron Gall encouraged participants at the National Potato Business and Marketing Conference to become innovators and visionaries. He wants us to become dreamers…

"Not the sort of dreamers who sit around and dream of what might have been. I'm talking about becoming the sort of people who have a vision for the future and the foresight and confidence to take the necessary steps to make it happen.

The most successful visionaries and innovators in history have been very practical and determined people.

Some have had dreams of building a better, fairer society – like Martin Luther King and Nelson Mandela. Others have dreamed of building successful business empires based on well-defined concepts – like Bill Gates.

What these visionaries had in common was a clear idea of what they wanted to achieve - where they wanted to be in the future, and the steps they needed to get there. Most important of all, they had the confidence – the belief in their vision - to get on and make it happen.

In the potato industry, we too need innovators, visionaries. If we're going to move forward, get a larger share of the market and compete successfully with products like pasta and rice, then we've got to be innovators.

There are risks of course. Innovation is a gamble – but so is standing still. In fact, I would argue that standing still is a riskier strategy.

So what exactly do I mean by innovation – new, novel, fresh, green, change, alteration, transformation, newfangled, re-invention. Those are just a handful of meanings – but you get the idea. Essentially, innovation means a re-packaging or re-invention of an existing product. I think innovation also mean attitude – a readiness to constantly look for new methods, new approaches, new ways of making a product appealing and attractive to customers.

How many of you remember the old Red Wing Scooter - what did they do with it?

What an incredible piece of innovation that was. Someone was smart enough to recognise that the clunky old scooters of our youth could be re-packaged in a way that would make them appealing to today's kids – and their parents.

They took the basic two-wheeled design, made a much lighter model which could fold up and be carried easily carried on buses, in cars, even in planes. They marketed it aggressively – and the rest, as they say, is history.

We need to start thinking about the potato in the same way. How can we re-package it so there is a new or bigger market for it, and preferably a market that is prepared to pay a higher price. We're already doing this to some extent.

If you think back a few years, it was the norm to sell brown, unwashed potatoes in 20 kg bags. Then a few growers realised that a significant number of customers would be prepared to pay more for washed potatoes because these customers had less time and more money than in the old days.

The first growers to provide washed potatoes enjoyed a market advantage over other growers. Now everyone's doing it. Washed potatoes are a core part of the market – at least 62% in New Zealand.

Recent customer research in New Zealand showed that the optimum price people are prepared to pay for a 10kg bag is $7.50 or 75c/kg. Compare that with around $5 or $1/kg for a 5kg bag and $4 or $1.30 for a 3 kg bag. If we sold only 5kg and 3kg bags we'd increase profits for everybody in the chain – with very little effort.

As well as being innovators – we need to be social scientists. We need to look at how society has changed and how people's lives have changed.

A decade or so ago, if we'd asked people how we could make brown unwashed spuds in 20kg bags more appealing, I doubt anyone would have come forward and said: "Please wash them and put them in smaller bags." But when some growers were smart enough to start doing this, customers rapidly responded by opening their wallets and paying higher prices.

So if customers can't tell us how to re-package products successfully, how do we know? It's up to us to use our imaginations, look at changing lifestyles, and look at what is being done with other products.

Households are often smaller. In New Zealand more than 50% of our customers are in one and two people households. If you're living alone, you don't want huge bags of veggies and you want something quick and easy to cook.

People are busier, they have less time to cook and they're more health conscious. That means they want fresh vegetables and fruit – but only if they come packaged in a way that means little time or energy is in involved in getting them onto the table.

We need to get into the mind-set of these customers. Pasta and rice are popular because they're perceived as quick and easy – no peeling, no chopping, just straight into a pot of boiling water, and onto the plate. Washed spuds don't actually take much more time and they're much more versatile – they can be sliced, diced, mashed, baked, roasted. So we need to get that message across. But we could also add-value.

There are various ways of doing this. The Tesco's chain in the UK sells New York-style potato wedges with a sour cream dip – pop them in the oven and they're ready in half and hour – put them on the table, and add the dip.

The Express Bake PotatOH!! from the United States is a baking spud wrapped in gladwrap ready to pop in the microwave.

Another popular type of packaging overseas is "use" labelling. Potatoes are labelled as baking, or boiling, or multi-use. "Use" labelling is now pretty regular in New Zealand, particularly with speciality potatoes.

We're not the only food producers needing to re-invent our products. Everyone is having to. Some sectors are doing it brilliantly - water and milk for example.

You can buy blue top, green top, lite-blue, calci-trim, flavoured milk, organic milk and customers are lapping it up!

Washed baby carrots are sold in school-lunchbox size packs, capsicums are packed in threes – one red, one yellow, one green.

So what should we be doing?

We must start thinking ahead. We must work out where we want to be in five years time and put in place realistic plans to achieve those goals. I believe that one of those goals must be to start producing the sort of value-added, quick and easy potato products that are already available in Britain and the United States.

Yes, the United Kingdom and the United States are much bigger markets, so let's cut our cloth to suit the market. After all, in Australia and New Zealand we have more than 20 million customers.

If the traditional processors are not going to get into this new market then maybe growers themselves should. Of course it doesn't make sense for individual growers to go to the expense of setting up processing plants to produce added-value products. But it makes very good sense for growers to combine and invest in one processing plant – or one in each country - to do it for everyone. Taking that step, investing in the future, would be a gamble. But as I said at the outset of this speech, not doing so - standing still - is a much higher-risk strategy.

Finally, one of the best examples of innovation I have seen (without genetic modification). It was produced in Japan by a very clever chap, a grower who realised that people loved their melons but had trouble fitting them in their crowded fridges. So he experimented with growing melons in square buckets – and came up trumps. That's what I call thinking outside the square. That's what the potato industry needs to do.

Ron Gall,
Executive Officer
New Zealand
Vegetable &
Potato Growers
Federation (Inc)

GMO
snippets

International Horticultural Projects

India and Russia

Potatoes resistant to 'potato virus Y' are being investigated by researchers in India, whilst Russian farmers may soon have access to a GM potato resistant to the Colorado beetle.

Market Research

Europe

Eurobarometer surveys have been conducted in Europe for the European Commission since 1973. The results of the most recent survey were released in December 2001, and contained more information about perceptions of gene technology than before.

The survey took place between May and June 2001, and involved 16,029 people from 15 European countries.

Findings include:

- two-thirds of respondents consider themselves poorly informed about science and technology
- 59% believe they understand what GM foods are
- when it comes to buying GM food, 94.6% of people wanted the right to choose
- GM foods were believed to be dangerous by 56% of respondents
- age did not appear to indicate a greater acceptance of gene technology. 64% of 15-24 year olds and 7% of those aged 65 and up rejected the technology
- 59% of respondents believe GMOs have a negative impact on the environment
- a higher level of education did not mean a greater level of acceptance for the technology. 58% per cent of those who had left school by the age of 15, and 53% of those who had studied beyond the age of 20, were opposed to GM food
- 33% of respondents agreed with the statement that "the dangers [of GMOs] have been exaggerated by the media".

United Kingdom

A poll of more than 2,000 farmers in the UK has found that more than half of those under the age of 30 (55 per cent) supported field trials of GM crops, despite public wariness about the technology. Forty-seven per cent of those aged 31-60, and 48 per cent of those aged 61 and over also supported GM crop field trials in the UK.

Australia

According to market research results obtained by the Commonwealth Government Agency Biotechnology Australia, Australian consumers are confused about GM and organic foods.

Australian consumers incorrectly believe:

- genetically modified fresh fruit and vegetables are sold in Australia
- most foods sold here are genetically modified
- everything that isn't organic is modified in some way.

For more information: www.biotechnology.gov.au

A survey of 1,000 participants conducted in June by Market Attitude Research Services, for the Commonwealth Government Agency Biotechnology Australia found that:

- in relation to the perceived benefits of GM foods, 75% of respondents stated decreased use of pesticides and chemicals on crops, and 69% believe that agricultural land would be more efficiently used and that higher yielding crops would lead to less expensive food
- 53% of respondents believe that the risks of GM foods currently outweigh the benefits, and 43% of respondents feel that the risks will decrease with time
- 73% of respondents believe that they require more information about the technology
- people with questions about GM foods expect to get this sort of information from their doctors and medical practitioners, or by searching the internet.

Articles from the June and August editions of GMOs – Guiding Meaningful Opinions, The Gene Technology Newsletter of the Horticulture Industry – compiled by Agrifood Awareness Australia for Horticulture Australia Limited.

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Field Proven in Australia and New Zealand

The seed pick-up system is designed to overcome the problems associated with the 'cup' system (seed falling out of the cup - resulting in missed seed placement). The unique adjustable spring loaded clamp mechanism ensures a positive pick-up and release of all types of seed - round or cut, without damage to the seed piece. The planter can be successfully operated in all terrain without the need for an operator on the planter.

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Complete M delivers clean balanced nutrition with high-energy productivity to give today's grower what they need. Complete growing power using new era science that supersedes old technology products. Hi Fert's world patent coating technology lets you use quality base fertilizers and coat key elements that enhance the performance of nutrient blends. For more information contact your Hi Fert Agent or call (03) 9685 6000.

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