Potato Australia

PUBLISHED BY THE AUSTRALIAN POTATO INDUSTRY COUNCIL

VOLUME 9 SEPTEMBER 1998 ISSN 1036 – 8558

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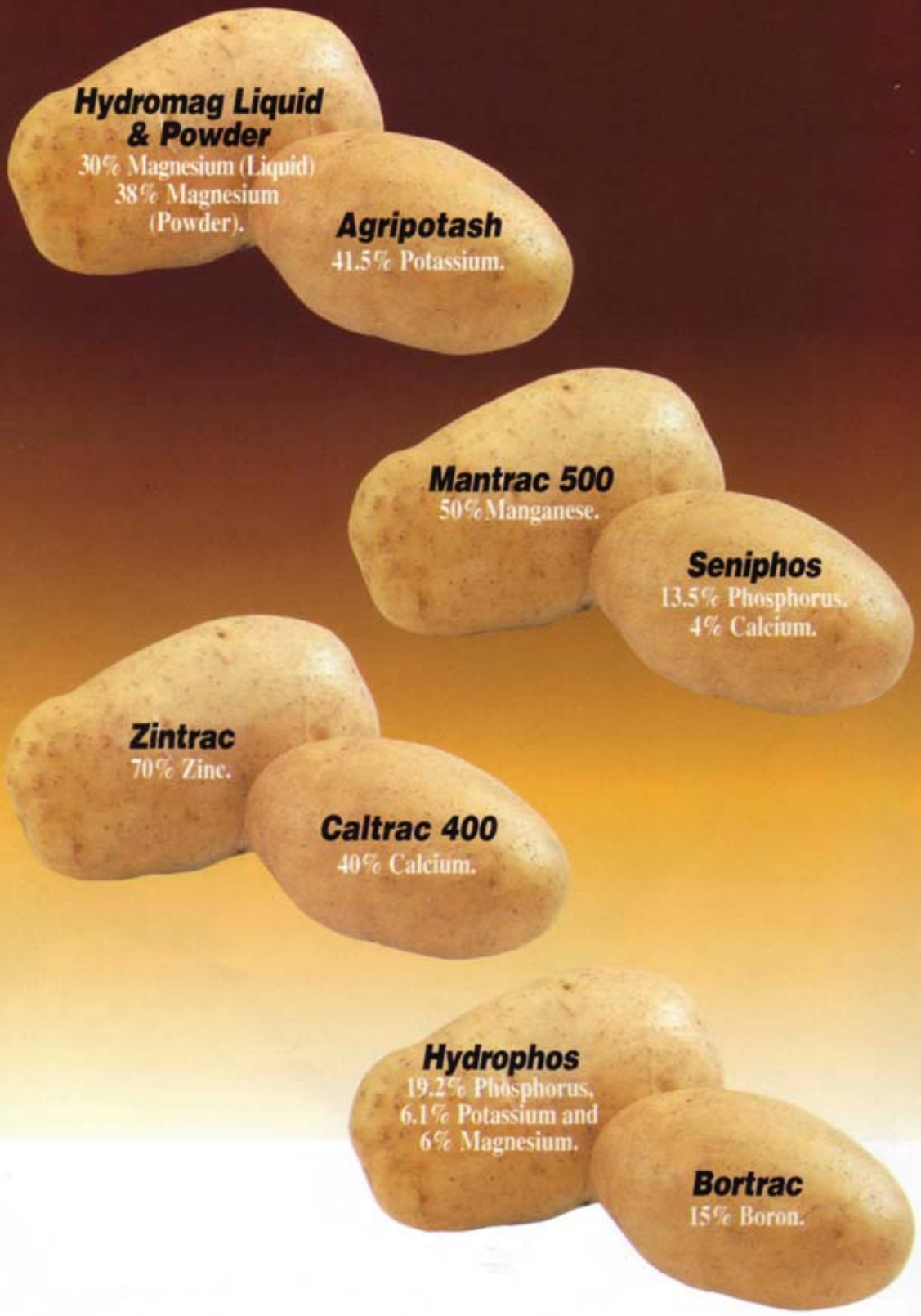

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Editorial

Welcome to the 1998 edition of Potato Australia. It has been a year of change and keeping up with the new developments has been a challenge for all of us.

In this edition we have quite a large number of articles with a lot of excellent information coming out of our research programs.

Our goal from now on is to report on all projects in progress whether it be in the form of a brief summary or a full article. This means that growers will have a better idea as to the progress being made and whether any findings may be useful on-farm before the project is completed. Even if you are not sure whether something might be of value there is always the option of contacting the researcher directly.

We have also provided an overview of new projects that have recently gained funding through the Horticultural Research and Development Corporation.

The seed industry has been going through some major changes which we have been reporting in *Eyes on Potatoes* and in this edition we continue that focus. Tony Pitt has provided an interesting article that looks at buying seed and what you get.

In this edition we also have a fair bit of information about our customers. There is a report from the work done for the Choice article which some of you may have seen. There is also consumer research and food services industry research carried out for the development of the Industry Plans currently being put together. The results are not always what we would expect.

Just to finish on I must mention the owl story. Better still I will leave you to read it and make up your own mind. It is an entertaining piece that highlights the need to always think laterally.

From the editorial team I wish you all the best for the coming year.

Nathalie Jarosz - Editor

Leigh Walters - Assistant Editor

WARNING: ANY MENTION OF PRODUCTS DOES NOT IMPLY ENDORSEMENT NOR INFER REGISTRATION. CONTACT YOUR LOCAL DEPARTMENT OF AGRICULTURE OFFICE FOR ADVICE ON REGISTRATION STATUS.

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ACKNOWLEDGEMENT

Front cover: Courtesy of ForBio Limited

We also thank the Horticultural Research Development Corporation (HRDC) for its financial contribution towards the production and distribution of Potato Australia.

Chairman's message

IAN RICKUSS
is the Chairman of the
Australian Potato Industry Council
(07) 5465 8247

In the nine months since I have been chairman the only thing that seems certain in our industry is change. We have experienced the merger of Australia's two major crisping companies, the Asian economic crisis and the push for the adoption of QA and food safety programs.

We have achieved an increase in the maximum allowable cadmium levels in tubers from 0.05% to 0.1%. This was a sensible result for the industry and a lot of thanks must go to our past chairman, Wayne Cornish, for this conclusion.

The APIC R&D Committee has also been working on the development of Industry Plans. These have involved consultation with people from across the industry to make sure that they provided the direction that the industry is demanding of our research and development program.

If this is carried out successfully the economic future of all sectors of the industry will be secure rather than just some sectors.

The Potato Marketing and Promotion Levy submission has made it to Senator Judith Trouth's office having met the 12 criteria required and been approved by the Australian Horticultural Corporation Board. We are now waiting on government approval. This could take some time given the strange political times in which we live. Hopefully it won't be too long as the industry needs a bit of a help along. Increasing the amount of potatoes people eat would be a welcome change.

Making decisions about research and development projects can also be difficult when it involves our rapidly changing seed industry. A project to develop and implement national seed potato certification standards has been supported for the first year. Initially there was a delay due to the uncertainty about industry needs given all the changes that were happening.

We also have a wide range of new research and development projects starting up which are described elsewhere in the magazine. Besides the new work starting we have reports from the ongoing projects and those that have just been completed. Take a bit of time to glance through these as it is growers money that is funding a large part of the work.

I would like to thank Nathalie Jarosz and her team for their work on *Potato Australia* and *Eyes on Potatoes*. In today's rapidly changing world it is not easy to keep up and these publications are an important link to what is happening for us.

Also I would like to thank Max Walker and Jeff Peterson for their support and the many others in APIC, AUSVEG and the industry that help us work towards a better future.

Good luck and let us all have a good season. ■

Potato Australia is produced by the Department of Primary Industry and Fisheries, Tasmania, on behalf of the Australian Potato Industry Council.

Potato Australia
PUBLISHED BY THE AUSTRALIAN POTATO INDUSTRY COUNCIL

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HRDC Potato R&D Projects for 1998-99

Project title	Chief Investigator		Page
Crop management			
Developing soil and water management systems for potato production on sandy soils in Australia	Barry Philp, Primary Industries & Resources SA	08 8389 8821	#
NEW Effect of calcium nutrition on decay of summer sown seed potatoes	Dr Greg Howell, NSW Agriculture	02 6951 2510	**12**
NEW Enhanced biodegradation of soil-applied pesticides - determination, risk assessment and prevention strategies	John Matthiessen, CSIRO Entomology	08 9333 6641	**14**
Mechanisms of cadmium accumulation by potato tubers	Dr Mike McLaughlin, CSIRO Land and Water	08 8303 8433	**10**
More economic and environmentally responsible use of phosphorus fertiliser in potato cropping on krasnozem soils in Australia	Dr Leigh Sparrow, Tasmanian Institute of Agricultural Research	03 6336 5379	**10**
Remote sensing as an aid to horticultural crop recording and husbandry	Dr Rowland Laurence, Tasmanian Institute of Agricultural Research	03 6430 4901	**8**
Sustainable potato production in highland NSW - Stage III	Sandra Lanz, LANZ Agricultural Consulting	02 4883 6318	**46**
Sustainable use of reclaimed effluent water for horticultural irrigation on the Northern Adelaide Plains, SA	Dr Daryl Stevens, CRC for Soil and Land Management	08 8303 6700	**8**
National Potato Improvement & Evaluation Scheme			
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Breeding French fry potato varieties - Stage 2	Dr Roger Kirkham, Agriculture Victoria	03 5962 9218	**32**
Breeding fresh market potato varieties - Stage 2	Dr Roger Kirkham, Agriculture Victoria	03 5962 9218	**32**
Evaluation and development of new potato genotypes - South Australia	Dr Chris Williams, SA Research & Development Institute	08 8303 9323	**32**
Potato breeding & cultivar evaluation - Western Australia	Peter Dawson, Agriculture WA	08 9892 8444	**32**
Potato cultivar accession and testing in Tasmania	Dr Rowland Laurence, Tas Institute of Agricultural Research	03 6430 4901	**32**
Potato cultivar evaluation in Victoria and New South Wales	Dr Roger Kirkham, Agriculture Victoria	03 5962 9218	**32**
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Biofumigation – bioactive Brassica rotations for IPM of soil-borne pests and diseases	John Matthiessen, CSIRO Entomology	08 9333 6641	**9**
NEW Characterisation of Australian isolates of *Phytophthora infestans* and planning to manage new and more aggressive strains of the fungus	Lois Ranson, AQIS	02 6272 4878	**12**
NEW Cleaning and disinfection practices for potato farms	Dr Rudolf de Boer, Agriculture Victoria	03 9210 9277	**12**
Control of black nightshade and other weeds in potatoes	Ian Macleod, Serve-Ag Pty Ltd	03 6427 0800	**27**
Control of pink rot in field and storage	Dr Trevor Wicks, SA R & D Institute	08 8303 9563	**9**

Project title	Chief Investigator		Page
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Influence of rotation and biofumigation on soil borne diseases of potatoes	Dr Dolf de Boer, Agriculture Victoria	03 9210 9277	**8**
Investigation on common scab disease of potatoes and development of control methods	Dr Hoong Pung, Serve-Ag Pty Ltd	03 6427 0800	**8**
NEW Managing bacterial breakdown in washed potatoes	Dr Trevor Wicks	08 8303 9563	**14**
National strategy for the management of western flower thrips and tomato spotted wilt virus	Dr David Cook	08 9368 3250	**30**
New chemical treatments for fungal diseases of seed potatoes	Dr Dolf de Boer, Agriculture Victoria	03 9210 9277	**9**
NEW Screening potato and vegetable soil borne diseases that may be controlled by Eucalyptus leaf mulch - pilot study	Stuart Smith, Agronico Pty Ltd	03 6428 2519	**13**
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Aphid monitoring in the Scott River potato seed growing area of south-west Western Australia	Francoise Berlandier, Agriculture WA	08 9368 3249	**9**
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NEW Reduced chemical usage in seed potato production	Dr Greg Howell, NSW Agriculture	02 6951 2510	**13**
Technology transfer			
Coordinating technology transfer in the Australian potato industry	Leigh Walters, SA Farmers Federation	08 8232 5555	**60**
NEW Facilitating the introduction of electronic information products and services to the Australian Potato Industry	Nathalie Jarosz, Tasmanian Department of Primary Industries and Fisheries	03 6421 7637	**13**
NEW Field guide and reference books for pests, beneficials and diseases of potato crops	Dr Paul Horne, IPM Technologies Pty Ltd	03 9710 1554	**14**
Production and distribution of Potato Australia	Max Walker, Australian Potato Industry Council	03 6427 9606	†

NEW New projects - These have been approved and will commence once contracts have been finalised.
† - No report is produced on this project as the outcome is what you are reading.
# Progress report will be included in the December 1998 *Eyes on Potatoes*

Current HRDC project updates

One of the issues expressed by growers and other people working in the potato industry was that they did not hear enough about what was happening with the potato levy projects.

To help address the problem all researchers with projects still going in the first half of 1998 were requested to provide a brief summary of progress or submit a full article for *Potato Australia*. This means that in each *Potato Australia* all potato levy funded projects should be reported on in some way.

Where possible researchers have written articles. It is the nature of research though that it can take a few years before there is any worthwhile results to talk about. In these instances a brief summary is the next best option. If anybody wants to follow up the project further there is always the option of contacting the researcher directly. Phone numbers have been included for this purpose.

Projects starting in the second half of 1998 will be listed in the article, "New projects approved by HRDC".

Projects with a "**PT**" are totally or mainly funded from the potato levy. Those with a "**VG**" are mainly funded from the vegetable levy with some funding from the potato levy.

Sustainable use of reclaimed effluent water for horticultural irrigation on the Northern Adelaide Plains, SA.

(VG - Project started January 1998)

The project aims to determine the impact of using reclaimed effluent water in vegetable crops. This is done by comparing the biological, chemical and physical changes in soils irrigated with recycled water and bore water, or not irrigated at all.

Preliminary indications from initial soil surveys indicate there were both beneficial and detrimental chemical changes occurring as a result of using reclaimed effluent water. Work is currently underway to confirm these findings and develop management strategies for dealing with any problems.

Other parts of the project include looking at the impact of reclaimed effluent water on the groundwater and whether the use of this water effects the uptake of cadmium by potatoes.

DARYL STEVENS
CRC for Soil and Land Management, SA
(08) 8303 6700

Influence of rotation and biofumigation on soil-borne diseases of potatoes

(PT - Project started July 1996)

The aim of the project is to undertake long-term studies on the effects of different crop rotation strategies on diseases caused by soil-borne organisms. It is a collaborative effort involving researchers from Agriculture Victoria, South Australian Research and Development Institute and New South Wales Agriculture.

Eight field trials are under way at different sites in Victoria and South Australia and will be harvested between early April and late May.

The trials are designed to evaluate the effect on disease and yield of potatoes of different rotation crops and pastures, Indian mustard seed meal incorporated into the soil and the timing (early/late) and method of seed-bed preparation (cultivated/herbicide).

Preliminary results indicate that Indian mustard and fodder rape residues ploughed into the soil prior to planting suppressed *Pratylenchus* nematodes and weed populations. In an experiment on seed-bed preparation, cultivating a pasture close to potato planting resulted in a lower yield than when pasture was cultivated earlier. Late cultivated treatments had somewhat more plants damaged by *Rhizoctonia solani* but less tubers affected by black scurf than the early cultivated treatments.

Further work will examine the effects of brassica (eg. fodder rape, Indian mustard) on rhizoctonia, powdery scab, black dot and *Pratylenchus* nematodes.

A survey to examine the relationship between crop rotations and nematode populations will be conducted in the Riverland areas and field trials are being planned for the coming Spring.

RUDOLF DE BOER
Institute for Horticultural Development, Vic
(03) 9210 9222

Investigation on common scab disease of potatoes and development of control methods

(PT - Project started July 1996)

Studies are being conducted to examine the use of chemical products and application methods to control common scab in the seed and in the soil. Treatment methods include chemical seed dressings, soil applications or both Preliminary findings indicate that common scab in the seed can be eradicated or drastically reduced with chemical products such as mancozeb and fluazinam. The chemical control of common scab in the soil appears to be dependent on the amount of disease present and other field factors.

Field surveys are being conducted for the duration of this project to investigate field conditions and practices which can influence common scab. Preliminary findings were published in last years edition of Potato Australia.

HOONG PUNG
Serve-Ag Research, Tas
(03) 6427 0800

Remote sensing as an aid to horticultural crop recording and husbandry

(VG - Project started August 1997)

The aim of the project is to determine if satellite imagery can distinguish between the many horticultural crops grown in Tasmania. If individual crops can be recognised then the establishment of growth and yield patterns could lead to large scale monitoring of husbandry influences. In addition, it would provide the basis for a simple and cost-effective paddock inventory system, recording such information as paddock contents and pesticide applications over time.

To date the group has collected paddock information, acquired satellite imagery and is now beginning the data processing phase.

The work is also supported by Botanical Resources Australia.

ROWLAND LAURENCE
Tasmanian Institute of Agricultural Research
(03) 6430 4901

Biofumigation – bioactive brassica rotations for IPM of soil-borne pests and diseases

(VG - Project started July 1997)

The project is investigating the natural occurrence of fumigant-like compounds in brassicas and their effects on soil-borne pests and diseases. This will be done by selecting appropriate types for use as a crop, for grazing or as a green manure within a rotation.

Screening of many brassicas has shown there is a large difference in their toxicity to pests. Root tissue is generally more toxic than shoot tissue. The work is revealing the chemical and genetic basis of the biofumigant effect in brassica plants which will allow improvement in biofumigation properties.

The first fodder brassicas with high biofumigation potential have been selected from current commercial lines and have recently been released. These lines have not been deliberately bred for their biofumigant effect.

Breeding based on a better understanding of the biofumigant effect offers the possibility of improved biofumigation potential in future varieties.

JOHN MATTHIESSEN
CSIRO Entomology, WA
(08) 9333 6641

Control of pink rot in field and storage

(PT - Project started September 1997)

The aim of this project is to develop methods of controlling pink rot in the field and to eliminate losses occuring in storages.

Over the past 12 months we have carried out glasshouse and field experiments to fine tune the management of pink rot. In a glass house study we compared Ridomil 50G® granules applied at planting with either a new formulation of Ridomil (Ridomil Gold MZ®) or phosphonic acid sprays. In this trial soil was artificially infected with the pink rot fungus and flooded on two occasions between applying fungicides. Both Ridomil formulations controlled pink rot and increased yield while the Phosphonic acid treatments had no influence on yield or disease control.

Field experiments have been conducted on two commercial properties in the South East of South Australia where Ridomil Gold MZ (2.5 or 5 kg/ha) or Phosphonic acid (6 or 12 l/ha) was applied three times at 10-14 day intervals beginning at 10-20mm tuber size. In one trial the Ridomil treatments produced less infected tubers at harvest compared to other treatments.

So far the glasshouse and field experiments have shown that Ridomil is a very effective material for the control of pink rot but the results with phosphonic acid have been inconsistent.

A number of chemicals as well as several potential biological agents are being evaluated as alternatives to Ridomil as it is unwise to rely on one chemical for disease control.

We also plan to determine the soil water conditions that are a key factor in triggering this disease.

Other studies evaluating methods of detecting the fungus in soil, varietal susceptibility, spread in storage and effect of biofumigants are continuing and will be reported at a later stage.

BILL DAVOREN AND TREVOR WICKS
South Australian Research and Development Institute
(08) 8303 9587

Production and assessment of virus resistant potato cultivars

(PT - Project started July 1997)

The project is using genetic engineering approaches to develop cultivars and breeding lines which have resistance to several virus diseases.

Last season we grew our first engineered plants in a field trial. All the plants produced good yields and no off-types were seen. Tubers from these will be used for more trials where plants will be challenged with virus.

JAMES HUTCHINSON AND PETER WATERHOUSE
Agriculture Victoria and CSIRO Plant Industry, ACT
(03) 9210 9222

New chemical treatments for fungal diseases of seed potatoes

(PT - Project started July 1997)

A survey has shown that a high proportion of seed potatoes have skin diseases that affect their quality. Real improvements in the management of the fungal diseases on seed potatoes is needed including a wider choice of treatments that are effective against the different diseases and reduce the risk of resistance.

This project is evaluating new chemicals being developed or already in use overseas and will facilitate the process of registration. It is also gathering the latest information from overseas on the management of seed and soil borne diseases.

Two field trials have been harvested at Ballarat and Gerangamete in Victoria and two glasshouse trials have been harvested. Data has still to be analysed.

New developments in the industry have included the registration of the fungicide Fungaflor“ 750 WP (750 g/kg imazalil: Janssen Cilag) for the control of silver scurf, fusarium dry rot and gangrene dry rot in time for the 1997-98 growing season. This provides an alternative to the standard treatment Tecto Flowable Fungicide“ (450g/l thiabendazole). The two chemicals can be mixed and the availability of both in the marketplace provides growers with some options of practising chemical resistance management strategies.

The fungicide Monceren 250 FS (250 g/l pencycuron: Bayer Australia Ltd) has also been registered as a pre-plant seed treatment for the control of seed-borne black scurf (*Rhizoctonia solani*) providing growers with a third option for the control of this disease.

RUDOLF DE BOER
Institute for Horticultural Development, Vic
(03) 9210 9222

Aphid monitoring in the Scott River seed potato growing area of south-west Western Australia

(PT - Project started July 1996)

An aphid survey is being conducted to determine the suitability of the Scott River area of south west Western Australia for seed potato production. So far, a third of the winged aphids found were species capable of spreading potato leaf roll virus.

Winged aphid numbers were lowest during the hot months of January and February, and peaked in April. Colonising aphids, often found on the lower leaves of potato plants, are most numerous in March.

In the 1997-98 season, few colonising aphids were found, as a rigorous spray program was implemented. Growers are urged to conduct weekly aphid monitoring, and to spray only if aphids are found.

FRANCOISE BERLANDIER
Agriculture WA
(08) 9368 3249

Innovative transport and disease control systems: potato exports to Asia

(PT - Project started January 1998)

When exporting potatoes in non-refrigerated containers rot can be a problem in the latter part of long voyages. Unfortunately the economics of exporting potatoes using refrigeration are marginal. Successful systems for export of large quantities of potatoes from Australia (other than for short voyages), therefore require the development of a reliable and economic post-harvest system for transport without refrigeration.

The aim of the project is to develop specific handling protocols for use by growers, exporters and shipping companies for exporting high-quality, fresh potatoes to markets in Asia.

Initial field surveys of handling practices show that they vary greatly from grower to grower and have a marked influence on storage life. Work on disease control confirms that proper curing is critical and that natural disease control has the potential to be commercially feasible. Development of a customised, non-refrigerated container for potatoes continues.

ALISTER SHARP
Food Science Australia, NSW
(02) 9490 8333

Mechanisms of cadmium accumulation by potato tubers

(PT - Project started July 1997)

The aim of the project was to determine the mechanisms responsible for the differences in cadmium accumulation by potato cultivars. Understanding why some cultivars

accumulate more cadmium in the tubers than others will assist in the development of future management strategies, particularly plant breeding for low cadmium potato cultivars.

A pot trial was undertaken to measure the total uptake and distribution of cadmium within plant components of two potato varieties, *Wilwash* and *Kennebec*. These cultivars have been shown to differ in the concentration of cadmium found in the tuber.

In confirmation of previous results, cadmium concentrations in the tubers of *Kennebec* were significantly greater than *Wilwash*. However, the total plant cadmium uptake did not differ significantly between the cultivars, suggesting that the difference in tuber cadmium concentration could not be explained by a difference in total cadmium uptake.

Furthermore, the concentration of cadmium found in both the new and old leaves of *Wilwash* was significantly higher than in *Kennebec*. This indicates that the difference in tuber cadmium concentration is due to differences in uptake of cadmium within the plant.

Given the importance of phloem* transport in tuber filling, it is likely that cadmium transfer to the phloem and then to the tuber is a critical difference between the cultivars. Further experiments are needed to determine the pathway of cadmium to the tuber to confirm this hypothesis.

** Phloem is the conducting tissue which transports such things as proteins, sugars and some minerals through the plant. In conjunction with the xylem it forms the vascular tissue which provides the transport system of the plant for food, water and wastes.*

MIKE MCLAUGHLIN AND KELLY DUNBAR
CSIRO Land and Water, SA
(08) 8303 8433

A national strategy to reduce cadmium accumulation in potato crops

(PT - Project started July 1994)

The project has evaluated management strategies to minimise cadmium accumulation in potatoes.

Development of pre-plant and post-plant tests for predicting cadmium risk in irrigated potato production have been finalised and grower information detailing the technology is currently being put together for release.

Work has also been carried out to examine the use of soil ameliorants to reduce the cadmium accumulation in tubers, particularly in saline soils. Very promising results were obtained in glasshouse trials using waste materials from water treatment works which reduced tuber cadmium concentrations markedly. These materials have subsequently been trialed under field conditions at three sites in South Australia. Experiments were harvested in March and April 1998 and tubers and soils from these trials are currently being analysed.

An industry workshop is planned for later in 1998 to review the results from this and other projects examining cadmium in horticulture.

MIKE MCLAUGHLIN
CSIRO Land and Water, SA
(08) 8303 8433

More economic and environmentally responsible use of phosphorus fertiliser in potato cropping on krasnozem soils in Australia

(PT - Project started February 1998)

Krasnozems (red soils on basalt) tend to 'lock up' a lot of phosphorus and need higher applications of phosphorus fertiliser than most other Australian soils. The project looks at ways to apply phosphorus more efficiently to these soils.

A postgraduate student, Peter Johnson, was appointed in February. He has carried out a literature review on the topic and a research plan has been developed based on the review. Field trials will be set up in spring.

The fertiliser companies, Pivot and Impact are also providing support.

LEIGH SPARROW AND PETER JOHNSON
Tasmanian Institute of Agricultural Research
(03) 6336 5379

■

HRDC

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New projects approved by HRDC

JONATHAN ECCLES
is the Project Manager (Potatoes) with HRDC
(02) 9418 2200

Fourteen new projects have been approved (some subject to further negotiation) by HRDC.

This is in addition to the 29 continuing projects, approved in previous years. The new and continuing projects combine to make up a total of $1,792,800 in potato R&D grants for the coming year.

This is a significant investment in the future of the Australian potato industry.

Potato levy collected 97-98	**$989,642**
Voluntary contributions	**$107,000**
Government matching contribution	**$ 896,400**
Potato R&D program 97-98	**$1,792,800**

A brief overview of each of the newly approved projects follows.

Characterisation of Australian isolates of *Phytophthora infestans* and planning to manage new and more aggressive strains of the fungus

New strains of the late blight (Irish blight) fungus *Phytophthora infestans* spreading throughout North America and Europe are proving to be very expensive and difficult to control.

In Australia the disease which affects foliage and tubers, occurs only sporadically in some districts of Victoria and Tasmania and can be controlled with the fungicide metalaxyl (Ridomil®).

However, the new strains overseas are more aggressive, infect the crop earlier in the season and can cause damage under warmer, drier conditions that normally would have retarded the disease. As a consequence, crops are being devastated in areas where late blight was not a problem in the past. To make matters worse, the new strains are resistant to metalaxyl and related fungicides.

The introduction of new strains into Australia could have a devastating impact on potato production.

The aim of this project is to establish that Australia is still free of the new strains of *P. infestans* by determining the strain type and sensitivity to metalaxyl of isolates of the fungus from around Australia, to take action to prevent the introduction of new strains and to develop management strategies to minimise the impact of the new strains should they be introduced.

Project duration: 1 year

Lois Ransom, AQIS
(02) 6272 4878

Effect of calcium nutrition on decay of summer sown seed potatoes

In areas where two crops per year are grown in sandy soils, soft rots sometimes cause poor establishment of the second crop.

Previous studies have shown that there may be a link between low calcium levels in tubers and tissue breakdown. In potatoes other nutrients may interact with calcium to allow the entry of disease under certain weather conditions.

This project aims to investigate the interaction of seed piece handling, weather and nutrient applications on the development of soft-rots. Effective nutrient management may protect tubers from soft-rots, both in and out of the field, resulting in decreased costs for both the grower and consumer.

Project duration: 3 years

Greg Howell, NSW Agriculture
(02) 6951 2510

Cleaning and disinfection practices for potato farms

This project aims to provide growers with practical disinfection practices, as part of farm hygiene, to help improve potato quality and minimise the risk of the inadvertent spread of the major seed and soil-borne potato pathogens.

Diseases can have a dramatic impact on farm incomes, particularly in the seed and washed fresh-markets where reduced quality from skin blemishes can reduce incomes by 20% or more.

This project will evaluate the effectiveness of different classes of commercially available disinfectants against the major potato pathogens on a range of surfaces found on potato farms, evaluate different cleaning and disinfection practices, determine which diseases can be managed in this way and provide guidelines for growers on the best methods for disinfection.

Project duration: 3 years

Rudolf de Boer, Agriculture Victoria
(03) 9210 9222

Potato export market development

While the Australian potato industry has been primarily domestically focused in the past, there are massive opportunities emerging for expansion into Asian markets, as demand for potatoes in snack and fast foods expands and Asian diets Westernise. Opportunities exist for exports of seed, germplasm, fresh, fresh for processing and processed potatoes from Australia as well as related technology and agribusiness services.

Currently there is no mechanism for co-ordinated marketing and promotion by the potato industry overseas and independent exporters are operating in isolation and frequently in competition with each other for the same customers. This leads to a lack of focus and an inability to present a co-ordinated position to prospective customers. Additionally, the industry has no ability to gather market intelligence, monitor and identify market trends and prepare co-ordinated responses to emerging export opportunities.

This project will study the roles and relationships of all sectors of the Australian industry involved in potato exports with the aim of improving our competitiveness through larger operations. This will be achieved by facilitating the development of stronger strategic alliances and joint ventures, and through the attraction of major investment.

The project will also facilitate the development of a mechanism for gathering and disseminating market intelligence and maintaining quality standards as well as supporting a coordinated marketing and promotion program for export markets.

Project duration: 2 years

Russell Sully, Agriculture Victoria
(03) 92109222

Developing a product description language for potatoes

A Product Description Language (PDL) is a set of photographs with minimal text which describes various quality attributes of a product. It is the 'language' from which specifications can be developed or negotiated between suppliers and customers. For a product such as potatoes, the attributes are those most commonly used by the production and marketing chain, including consumers, to describe quality. These include soiling, greening, blemishes, shape, sprouting, cracking and a range of disorders.

By using a PDL, negotiations do not have to happen in person. If both parties to the transaction have a copy of the PDL before them, they can communicate using the same (pictorial) language regardless of the distance.

This project will link in with a major potato project being undertaken by Agriculture Victoria at Knoxfield. The proposal will ensure that the Potato PDL becomes one of a family of PDL's. There are a number of advantages to this approach, including:

- A national and international perspective, with the opportunity to link in with the 'Australia fresh' brand identification.
- Strong domestic and international retail linkages which have expressed support for the current PDL publications.
- The opportunity to compliment existing AHC retail activities such as 'Retail Watch' and merchandising.
- Less confusion with retailers, importers, wholesalers, etc if there is a consistent approach and format.

Project duration: 1 year

Richard Bennett, Australian Horticultural Corporation
(03) 5831 3919

Reduced chemical usage in seed potato production

The certified seed potato industry has expressed interest in lessening the chemical load that it places on the environment and leading the way for ware and processing-potato producers to provide the market with a cleaner, greener and more sustainably produced product.

This project aims to demonstrate the suitability of currently available technologies, which utilise simple electromagnetic radiation (EMR) at ultra violet (UV) or infra red (IR) wavelengths, to augment or replace some of the chemicals used in seed potato production.

One option is flame cultivation technology. Intense infra-red radiation, produced by a powerful tractor-mounted propane burner, is directed onto the target plant causing an instant flash-burn as it passes over the plant. Such burns eventually kill the plant but do not set fire to it.

In the United Kingdom commercial flame cultivators have been adapted to killing potato vines but their effectiveness has not been demonstrated under Australian conditions. Flame killing not only lessens dependence on potentially dangerous chemical defoliants such as Diquat or concentrated sulphuric acid, but it also kills weeds, pests and diseases in treated paddocks.

Carefully controlled irradiation of seed-potatoes could also be used to treat the tuber surface, thus reducing any potential pathogen load that might be exported with the seed potato crop. At present, producers rely on a range of toxic chemicals for this purpose.

This project intends to investigate the suitability of existing EMR processes as a replacement for conventional surface seed-potato treatments. EMR treatment of tubers could also benefit the ware and processing industries as it protects against storage diseases, can easily be placed onto a grading line, leaves no residue and hence has no withholding period.

Project duration: 1 year

Greg Howell, NSW Agriculture
(02) 6951 2510

Attendance at the IMI Fungal Identification Course, UK August 1998

Accurate and rapid diagnosis of plant diseases is extremely important to the potato industry.

Mrs Barbara Hall, Plant Diagnostician in Horticulture Pathology, SARDI, Waite campus, will attend the six week "International course on the Identification of Fungi of Agricultural Significance", at the International Mycological Institute (IMI) in Surrey, UK to be held between 10 August and 18 September 1998.

The IMI is a centre for excellence in Mycology, and is part of the Center for Agriculture and Biosciences International. This course is run annually and there are no similar courses in Australia.

Mrs Hall presently manages the Horticulture Pathology diagnostic laboratory in South Australia and is involved in many potato and industry funded projects. Attendance at this course will enable her to update and improve her skills, especially diagnosing plant diseases that are difficult to identify.

Project duration: 3 months

Barbara Hall, South Australian Research & Development Institute
(08) 8303 9562

Screening potato and vegetable soil borne diseases that may be controlled by Eucalyptus leaf mulch - pilot study

This project follows on from the extraordinary finding that Eucalyptus leaf mulch completely controlled onion white rot disease. The main objective of the project is to screen other soil borne diseases to test the spectrum of activity for this new control measure. The trial will involve pot tests for one season only, testing the following host-pathogen interactions:

- potato - common scab,
- potato - powdery scab
- potato - rhizoctonia
- brassicas - club root
- beans - sclerotinia
- potato - pink rot.

Depending on the outcome of this pilot study, further research will then be proposed to fully investigate any successful control.

Project duration: 1 year

Stuart Smith, Agronico Pty Ltd
(03) 6428 2519

Facilitating the introduction of electronic information products and services to the Australian Potato Industry

This project aims to raise understanding within the potato industry of the new technologies that are becoming available, how they may benefit the industry and in what ways we could take advantage of what they have to offer. At present, too few people in the potato industry understand what the technologies have to offer which impacts on the quality of debate and ultimately the decisions made about their use.

The project consists of four stages.

Stage 1 - Improving awareness of electronic information products and services through the media and making available a tool to speed up access to potato sites on the Internet.

Stage 2 - Benchmarking the current situation (this consists of four investigations).

(a) Identifying industry attitudes to electronic information products and services through a series of focus group sessions in four states.

(b) Investigating overseas electronic information products and services by visiting key overseas centres in the USA and UK.

(c) Investigating electronic information products and services in Australia.

(d) Investigating options for commercialising electronic information products and services.

Stage 3 - National workshop to present findings of investigations, demonstrate technologies, discuss implications and develop the basis for an industry strategy.

Stage 4 - Develop a strategy for facilitating the effective introduction of electronic products and services to the Australian Potato Industry.

Project duration: 1 year

Nathalie Jarosz, Tasmanian Department of Primary Industries and Fisheries
(03) 6421 7637

Managing bacterial breakdown in washed potatoes

Bacterial breakdown is a significant problem in washed potatoes throughout Australia. The disease is caused by Erwinia bacteria that rots potatoes in the field as well as in storage.

In washed potatoes the disease often develops after the tubers have been processed and packaged causing major losses to the processors and often a consumer backlash. The problem is exacerbated in South Australia where most processors use contaminated recycled water for washing.

The aim of this project is to develop management practices that eliminate or reduce soft rot in washed potatoes. Studies will be undertaken to identify the relative importance of bacterial infection in the field, washing plant or in storage and develop strategies that will control the problem.

This will involve evaluating chemical and physical methods to reduce infection in the washing plant and storage and will include treatments presently being evaluated in the nursery industry. Workshops on managing the problem will be undertaken in Western Australia, South Australia and Victoria.

Project duration: 3 years

Trevor Wicks, SA Research & Development Institute
(08) 8303 9563

Field guide and reference books for pests, beneficials and diseases of potato crops

The potato industry needs to consolidate its information on pests and diseases into a simple, easy to use field guide and industry reference book. Being able to identify pests, beneficial insects and diseases in crops, and also have up to date information on their management is a basic need for all potato farmers.

The importance of having up to date resource material cannot be understated. The potato industry has invested a significant amount of money on research into pests and disease control and it is important that the information generated by this research can be used by industry.

Two types of publications will be prepared; a field guide that is intended to be taken into the paddock and a more detailed book that is intended for reference.

Both the field guide and reference book will be important tools for farmers, the service industry (agribusiness, consultants, crop scouts, extension officers) and researchers.

Recent developments with the use of Integrated Pest Management (IPM) in Australia have shown how knowledge of what beneficial insects are in potato crops can reduce insecticide sprays. These books will give potato growers the ability to know what beneficial insects are present (or absent) in their crops and so help them decide whether to use insecticide sprays or not.

Key researchers, advisors and farmers in Australia will be consulted to ensure the publications meet the needs of people in all potato regions of Australia.

Project duration: 1 year

Paul Horne, IPM Technologies Pty Ltd
(03) 9710 1554

Development of extreme resistance (immunity) to common scab disease within current commercial potato cultivars

Common scab disease is the greatest economic constraint facing the French fry processing industry and is an important disease world-wide. Presence of this tuber-borne disease also threatens seed export markets.

Cultural and chemical control options for the disease are limited in what they can do. Current common scab R&D has intentionally focused on short term solutions to provide a much needed respite from this problem.

For the sustainable management of this disease long term solutions are required. Introduction of extreme and durable resistance to this disease in potato cultivars would meet this need. Cultivars resistant to common scab would provide significant savings to the producer, be environmentally friendly and would offer potential income to the Australian industry from export sales.

This project utilises a new and novel procedure used successfully for several other bacterial plant diseases.

Unlike with traditional breeding, we will produce clonal lines of Russet Burbank and Shepody with enhanced disease resistance without altering any of the important cultural characteristics of these cultivars and without using technologies such as genetic engineering which would limit product adoption and markets.

Project duration: 3years

Calum Wilson, Tasmanian Institute of Agricultural Research
(03) 6226 2638

Enhanced biodegradation of soil-applied pesticides - determination, risk assessment and prevention strategies

Use of the soil fumigant metham sodium is dramatically increasing in Australia as a control for soil-borne pests and diseases, and a replacement for methyl bromide.

In contrast, metham sodium use in Europe is in decline, after about twenty years of heavy use. This is due to problems with contamination beyond where it is applied and development of the phenomenon called enhanced biodegradation (also known as accelerated biodegradation).

Enhanced biodegradation occurs when soil microbes use the pesticide as a nutrient or energy source, breaking down or degrading the material so fast that it is no longer effective.

In Europe and the USA enhanced biodegradation of soil-applied pesticides is a major problem. The great difficulty is that once induced, almost nothing can be done to cure the problem. Affected soils recover with time, but rapidly revert following another application of the pesticide. Prevention is the only viable and responsible management option.

As it is still early in the cycle of widespread metham sodium use in Australia, preventative action is prudent to avoid a significant problem from developing.

The project aims to look at the risks of the phenomenon developing for various soil-applied pesticides, develop diagnostic methods for its detection and develop strategies to prevent or reduce the risk of its occurrence.

Project duration: 4 years

John Matthiessen, CSIRO
(08) 9333 6641

Development and implementation of National Seed Potato Certification Standards

Certification of Australian seed potato crops is currently administered by individual states with each state agriculture agency having a different certification standard and terminology (except NSW and Victoria where industry manages administration). This creates confusion for growers buying seed on the domestic market, and many overseas buyers do not realise there are varying certification standards between states.

There is a need to develop common national certification standard/s and terminology, and to educate all sectors of the industry as to what these mean in terms of seed quality

This project will be administered by the Australian Potato Industry Council (APIC) with day to day management being provided by Agriculture Victoria. It will be a 4 stage consultancy to:

- evaluate whether the Australian potato industry requires a national seed certification standard/s
- develop national seed potato certification standard/s and terminology
- prepare a manual and package of information about the standard/s and how they translate into tuber quality
- run a communication process to inform growers and industry about the certification standard/s

Stage 1 has been funded in this year. Further funding will depend on the outcomes from this stage. This project was to commence last year and was put on hold due to changes in the seed industry.

Project duration: 16 months (stage 1)

Russell Sully, Agriculture Victoria
03 6430 4901 ■

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Potato sector on brink of new technology

RUSSELL SULLY
is the Industry Manager Potatoes
JOANNE BATES
is a Public Relations Officer
both are at the Institute for Horticultural Development Agriculture Victoria
(03) 9210 9222

The high-tech nature of seed potato labs

The potato industry is under going a revolution which is threatening to turn industry on its head and will dramatically alter the way business is done in the future.

These changes are in response to the battle for market share and an attempt to satisfy the consumer's increasing demand for quality and service.

Increasingly food companies are seeking to add value to their products, in order to differentiate themselves in the markets from their competitors while at the same time delivering consistent, reliable quality and safe, healthy and convenient food.

Exclusive ownership of genetic material and varieties, supported by aggressive marketing and promotion of these branded varieties, can be seen right across the food sector and is emerging rapidly in the potato market.

For example, in the United Kingdom the major supermarkets' turn-over is dominated by their propriety brands (e.g. Woolworths 46%, Sainsbury 56%, Tesco 76%) and the same trend is becoming increasingly evident in Australia.

Integrated supply chains

As these companies move towards brand ownership there is a need for integrated and co-ordinated supply chains. They will provide consistency of supply, quality and traceability for food safety reasons, while maintaining control over production and distribution of their exclusive varieties.

To help achieve their goals, these companies sub-contract or franchise the production, storage, processing, transport and handling of all operations along the supply chain, including the supply of seed, and protect their intellectual property through such mechanisms as patents, licences and Plant Breeders Rights (PBR).

For growers who win the contract to supply these companies they find a lot of the market risk is removed, prices and supply specification are known in advance of planting the crop and market feedback is specific and regular.

These changes in the way potatoes are produced and marketed is seeing the emergence of potato seed and supply management companies who can potentially supply large volumes of consistent quality product at competitive prices.

The Australian seed industry now has access to rapid multiplication technology provided by companies such as ForBio and Southern Choice, Wrightsons, Technico and Sunrise Agriculture.

A spokesperson from the crisping sector said if a supply chain management approach was co-ordinated between the various stages of production, it could also help to unify the potato industry and identify priorities for future development.

Kan Moorthy, Potato Officer from the Institute for Horticultural Development in Victoria, said agronomic services will be a crucial element of rapid multiplication technologies, assisting growers in both the adoption of new technologies and production practices.

"The supply chain will link the grower to the customer, while simultaneously allowing the introduction of R & D and sharing of information through interaction along the production process," Mr Moorthy said.

Some of these companies are involved in the ownership, production and marketing of propriety varieties themselves, while others are producing mini tubers, plantlets and/or seed under contract for other growers and companies.

"The benefits of the rapid multiplication of certified seed will be that producers, processors and exporters can respond more quickly to demand," said BGP International Managing Director, Neil Barker.

"Increasing demand for the variety *Spunta* in Mauritius, New Caledonia, Tahiti and other tropical countries has resulted in a growing export of Victorian *Spunta* seed of just under 100 tonnes a year. The problem with the current system is that the number of mini-tubers produced each year is limited and bulking up a seed variety takes at least five to six years," he said

"The other benefits of mini-tubers are that they could significantly lower transport costs, because they are easier to handle and take up less room than next generation or bulked up potatoes," Mr Barker said.

Cosmetic potatoes

One of the major changes which has occurred in the marketing of potatoes over the last fifteen years has been the emergence of the "cosmetic potato" or the washed potato. This product offers convenient preparation to consumers and places very high quality standards on the visual appeal of potatoes.

What it boils down to is that loose washed potatoes with skin blemishes don't sell.

Irrigation technology has played an important role in the development of this product as it has allowed potatoes to be grown successfully on sandy soils where often rainfall is lower and less reliable. Sandy soils are very favourable for the production of cosmetic potatoes. This has driven the shift away from heavy soils to lighter sandy soil types, where

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Technico Pty Limited is an Agri-biotechnology company specialising in seed potato production.

Traditional certified seed potato schemes can take anywhere from four to six generations to build up economically priced volumes of seed potatoes.

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Commercial potato production can expect to achieve higher field yields with the use of earlier generation seed potatoes.

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A D V A N C E D P O T A T O T E C H N O L O G Y

coincidentally, large scale production under centre pivot irrigators is also feasible.

The cosmetic potato has placed greater emphasis on the need to reduce skin blemishes resulting from bruising, mechanical damage and greening, as well as diseases such as silver scurf, powdery scab, common scab, black dot, rhizoctonia and eel worm.

High health seed is seen as an important tool in reducing the risk of skin blemish diseases for the washed potato market.

The strong demand for this high health seed has created a new market opportunity for minituber and plantlet technologies, which with their increased rate of seed multiplication and reduction in the number of generations, have a lot to offer the potato industry over conventional technology.

Increased seed multiplication rates reduces the need for as many generations to achieve seed numbers, while at the same time reducing both the cost and the risk of soil borne disease build-up, which is responsible for skin blemishes.

"Supermarket chains are increasingly looking to category management, or supply chain alliances, that incorporates all production sectors, such as seed provider, seed producer, grower, packer, broker," said Queensland's Senior State Category Manager for Franklins, Martin Beattie.

"The links between supermarket chains and new minituber technologies are already happening and will become more prevalent in line with consumer-driven demands, taking into account the so called cosmetic appeal of potatoes as well as the consumer concern for quality," he said.

The future

In the near future we will see the almost complete disappearance of public potato varieties as processing companies and major retailers obtain exclusive ownership of propriety varieties, helping them to achieve competitive advantage in the production and marketing of their products.

Companies like Monsanto already have genes which, when introduced to potatoes, will offer protection against Colorado beetle. They are also well advanced in the development of genes which offer protection against potato virus Y, insects and fungal diseases, while imparting higher solids, better taste, longer shelf life, improved storage properties and less discolouration caused by bruising.

These genes will only be available to varieties protected by PBR and licences and to companies who can demonstrate that they can effectively manage and control the marketing and distribution of these potatoes. This is so that companies like Monsanto get an adequate return through royalties on their research and development investment.

The potato industry is becoming high-tech, vertically integrated and international. The supply chain is becoming more integrated and coordinated.

The electronic marketing of minitubers on the Internet shows how this rapid multiplication technology is being promoted as offering a competitive and quality advantage in local and world markets.

Companies such as Technico and Ag-Tec International's Quantum TubersTM (a US company) have websites advertising the benefits of becoming involved in the vertical integration process, promoting new minituber technology as being a guarantee of quality right throughout the supply chain.

The successful players of the future will be those who form strong strategic partnerships and become an integral part of the supply chain. They will be characterised by a "win win culture" and not the adversarial relationships which have characterised much of the relationships within the potato industry and food industry in the past. ■

Dr Gordon Prain (left) Director of CIP, SE Asia, Corina Horstra and Gisele Irvine looking at plants for minituber production to go to SE Asia

Field day for crisping potato growers to evaluate production procedures for plantlets

Seed technology developments

The development of new technology is a regular occurrence in this rapidly changing world.

The benefits of new minituber technologies for the potato production chain is that commercial growers and processing companies will have access to seed banks with a lower risk of contamination from soil-borne diseases.

The impact of the new mini-tuber technology on the seed and potato industries is yet to be determined, given that it's only recently become commercially available.

The technologies being promoted in Australia all have similar objectives, that is to increase the rate, quantity and quality at which seed potatoes can be multiplied.

Although the initial cost may be higher, the rapid multiplication and quality of the end product is estimated as rendering the per seed unit cost comparable to current mini-tuber prices.

All companies say that with the new technologies dormancy is not an issue, as mini-tubers or plantlets are delivered in field ready condition.

There is potential for the year round supply of potatoes, as mini-tubers and plantlets produced in controlled environments are available for planting throughout the year.

Mini-tubers produced through rapid multiplication technologies are graded to a uniform size to suit vacuum seeders and are conditioned to enable even field emergence.

Companies are also developing agronomic protocols to explain how growers can integrate mini-tubers and plantlets into current production techniques, using new or existing machinery and cultivation practices.

The technologies used to increase the multiplication rate of mini-tuber seed each have a different emphasis, although they are all based on tissue culture techniques.

Only Rovral controls three major fungal diseases of potatoes

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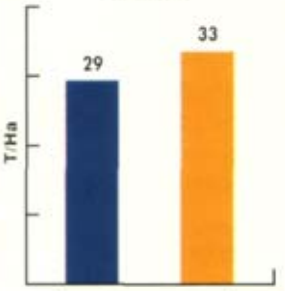

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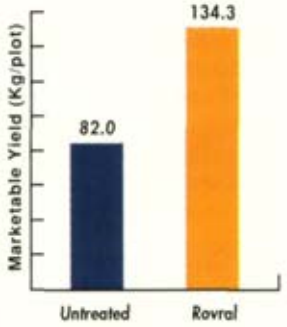

Rovral protects potato plants from Rhizoctonia, the disease that reduces yield and quality by attacking roots, stems, sprouts and stolons.

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Buying seed

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TONY PITT
is the Executive Officer with the Victorian Potato Growers Council
(03) 5623 4788

Certification does not mean disease free.

It does mean that the seed has complied with certain tolerance limits for certification, and for some diseases (such as bacterial wilt) this does mean zero tolerance.

For many potato diseases there are small but defined tolerances, while some diseases have no specification at all within certification schemes.

Seed potatoes that are *certified* are endorsed as having been produced in accordance with the conditions determined by the certifying authority. In practice this involves visual inspections of the crop and random checks on tuber quality after packing.

An analysis of some of the more common potato diseases in Australia has been undertaken in Table 3. The main source of crop infection, the role of certification, and critical management factors in containment are itemised for each disease. This analysis is by no means fully comprehensive, but it does provide an overview of the important issues for each disease.

Where potatoes are planted in new ground that has never before been planted to potatoes, seed-borne disease may be more important.

The inspection standards for certified seed are summarised in Tables 1 and 2. The field tolerance limits for crop inspection are similar in all seed schemes in Australia (Table 1), while the tuber quality standards are slightly different for the different state schemes.

Some seed buyers do query why there are any tolerances at all for disease in certified seed. Most seed crops are in fact grown with a clean bill of health. But if there is one problem plant in the crop, does that mean it should not be seed? What if there is 1 in 1000? There has to be a limit or tolerance set and this determines the minimum standards for certification. It does not mean that seed crops have these levels of disease, and mostly they have zero.

Some diseases (such as silver scurf and black dot) have no tolerance limits. Certification systems are designed with the primary objective of eliminating debilitating viral and bacterial pathogens from seed lines. In this they have been generally successful.

But the recent emphasis on blemish free potatoes has put additional expectations on certification schemes to provide a blemish free seed product. Seed potato certification schemes around the world are struggling with ways to cope with the requirements to limit skin blemish diseases such as silver scurf and black dot.

The relative importance of seed borne inoculum of these fungi compared to farm hygiene, seed storage and natural soil borne inoculum is a debated issue.

There may be other specifications that are used in preparation and packing of a seed lot for sale. The tolerances in Tables 1 and 2 are the minimum requirements. Some buyers do specify zero tolerance for diseases such as powdery scab and common scab.

Individual specifications are made for size based on a screen dimension. Container size, packaging, physiological age and level of black scurf may also be subject to individual specifications.

Independent pathology services can be used to confirm and quantify the disease levels in seed and this can be an area where both buyer and seller may decide to negotiate. ■

Table 1 Crop inspection standards
At the time of crop inspection, the following are the maximum tolerances for the crop to receive provisional certification status

Defect	ViCSPA	NSW	WA	Tas
Virus diseases	1%	1%	1%	1%
Wilt diseases	2%	2%	2%	2%
Bacterial wilt	0%	0%	0%	0%
Potato cyst nematode	0%	0%	0%	0%
Other diseases	2%	2%	2%	2%
Foreign varieties	0.1%	0.1%	0.1%	0.1%
Total diseased plants	2%	2%	2%	2%

Table 2 Tuber standards
At the time of tuber inspection after packing, the following are the maximum tolerances for tuber defects for the product to be endorsed as certified

Defect	ViCSPA	NSW	WA	Tas
Soft rots	0.5%	0.5%	0.5%	0.5%
Dry rot	2%	2%	2%	2%
Eelworm/scab:				
> 5sites /tuber	1%	1% (zero powdery scab)	1%	2% (common scab 4%)
< 5sites/tuber	1%	1% (zero powdery scab)	1%	2% (common scab 4%)
Insect damage	2%	1%		2%
Potato tuber moth	1.5%	1%		1.5%
Malformed	2%	1%		2%
Frosting / sunburn		0.5%		0.5%
Growth cracks		1%		2%
Mechanical damage	2%	5%	2%	2%
Stem end discolouration	2%			2%
Miscellaneous	1%			2%
Size range : Oversize	1%			2%
Undersize	2%			2%
Black scurf	Negotiated with buyer	Negotiated with buyer	10% medium scatter,2% large	10% medium scatter, 2% large
Maximum total defects	2% (except black scurf)			2% (except common scab, black scurf)

Table 3 Infection sources and critical management for some of the major potato diseases

DISEASE	DISEASE IMPACT	CAUSAL ORGANISM	MAIN SOURCE OF CROP INFECTION	OTHER SOURCES OF CROP INFECTION	PERMITTED TOLERANCE IN CERTIFIED SEED	CRITICAL MANAGEMENT FACTORS
Potato leaf roll	Reduced yield Reduced tuber size	PLRV	Infected seed for secondary infections	Self sown potatoes Other potato crops Aphid migrations	1% at final crop inspection	Use certified seed Monitor and xcontrol aphids. Control self sown potatoes
Other Virus diseases	Reduced yield	Virus X Virus Y Virus S	Infected seed plus insect vectors or mechanical transfer for primary infections	Mechanical transfer. Contact transfer on clothing and footwear	1% at final crop inspection	Use certified seed Monitor and control aphids. Isolate and limit movement into and through crops
Purple top wilt	Reduced yield Poor processing quality	Witches broom mycoplasma	Insect transfer	Infected seed Alternative host plants	1% at final crop inspection	Monitor and control leafhoppers Use certified seed
Bacterial wilt	Reduced yield Poor storage Contaminated land Farm quarantine	*Pseudomonas solanacearum*	Contaminated soil	Contaminated irrigation water Infected seed Contaminated farm machinery	Zero tolerance	Use certified seed. Farm hygiene. Isolate and quarantine affected areas. Identify and isolate other sources of contamination
Blackleg	Reduced yield	*Erwinia carotovora subsp atroseptica* *E. carotovora subsp carotovora*	Infected seed	Contaminated soil Contaminated equipment	2% of plants with a maximum of 2 % for all diseased plants. 0.5 % tubers	Use certified seed Farm hygiene Crop rotation Plant into loose and well drained soils
Common scab	Unmarketable tubers	*Streptomyces scabies*	Contaminated soil	Infected seed	Varies depending on th eseed scheme. 2% or 4%.	Maintain adequate soil moisture after tuber set Use certified seed. Avoid use of soil ameliorants (lime) just prior to planting
Pink rot	Reduced yield Poor storage	*Phytophthora erythroseptica*	Contaminated soil	Infected seed May be endemic to some soils.	2% of plants with a maximum of 2 % for all diseased plants. 0.5% of tubers.	Avoid excessive irrigation Improve drainage in poor areas. Strategic use of preventative chemicals Use certified seed
Fusarium wilt	Reduced yield Reduced tuber quality	*Fusarium oxysporum* *Fusarium solani* *Fusarium spp*	Natural inhabitant of many soils.	Infected seed Contaminated equipment	2% with a maximum of 2% for all diseased plants	Use certified seed Plant into loose and well drained soils. Chemical treatment of seed. Avoid seed with breakdown.
Black scurf	Reduced yield Unmarketable tubers Reduced tuber quality		Soil borne sclerotes in soil organic matter	Infected seed	Depends on the seed scheme. Levels often negotiated between buyer and seller	No freshly decomposing organic matter in the soil Clean seed. Seed treatment at planting. Mild soil temperatures between planting and emergence. Early harvest of seed crops.
Late blight	Reduced yield	*Phytophthora infestans*	Other potato crops	Self sown potatoes Crop trash Potato cull piles	2% with a maximum of 2% for all diseased plants	Initiated by prolonged mild and very humid weather. Strategic chemical treatment. Regional farm hygiene.
Early blight	Reduced yield	*Alternaria solani*	Other potato crops	Self sown potatoes Crop trash Potato cull piles	No specifications set	Initiated by cycles of wet and dry foliage. Limited with good crop nutrition. Strategic chemical treatment.
Gangrene	Tuber rots	*Phoma exigua*	Potato stores and handling equipment	Infected seed	2% with a maximum of 2% for all tuber defects	Handling potatoes in cold temperatures. Insufficient curing prior to cool storage.
Silver scurf	Loss of tuber quality	*Helminthosporium solani*	Potato stores	Infected seed Contaminated soil Contaminated potato equipment	No specifications set	Isolation of clean seed in storage. Strategic use of chemicals. Early harvest of seed crops.
Powdery scab	Unmarketable tubers Poor storage Contaminated land	*Spongospora subterranea*	Contaminated soil	Infected seed	Depends on seed sceme. Mostly 2%* with a maximum of 2% for all tuber defects	Free draining soils. Controlled soil moisture during tuber set. Use certified seed.
Black dot	Loss of tuber quality Minor yield loss	*Colletotrichum coccodes*	Contaminated soil	Infected seed	No specifications set	Regarded as an opportunistic pathogen which relies on crop stress to permit disease development. Farm hygiene
Potato cyst nematode	Reduced yield Contaminated land Farm quarantine	*Globodera rostochiensus*	Infected seed	Contaminated soil Contaminated equipment	Zero tolerance	Use certified seed. Farm hygiene. Farm quarantine. Plant resistant varieties in infested soils.
Eeelworm	Unmarketable tubers	*Meloidogyne spp*	Contaminated soil	Infected seed	2%* with a maximum of 2% for all tuber defects	Maintain adequate soil moisture through late tuber bulking Use certified seed

*For eelworm and scab, there is a tolerance of 1% for affected tubers with less than 5 sites/tuber and/or another 1% for affected tubers with more than 5 sites/tuber. The consignment still must comply with the limit of 2% for all diseased tubers .

Estimating the true demand for seed potatoes in South East Asia

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A new study has estimated the demand for seed potatoes in South East Asia to be about 32,000 tonnes annually.

Over the last five years, both the private sector and the government have given considerable attention to the potential to export Australian seed potatoes into South East Asia.

Whilst there is confidence in the long term potential in the market, there is much speculation as to just how big the market really is. Whilst estimates of up to 150,000 tonnes annually have been suggested, there will be a significant difference between the potential demand and what may be actually realised.

The demand for seed potatoes depends on the demand for fresh potatoes which is influenced by population growth and rising per capita income which has stimulated the demand for diversified diets. One of the most significant factors driving the increase in potato consumption in Asia is the growth in fast food franchises. There is a corresponding shift from potatoes as a staple food to a snack food.

Estimating the size of the market

There is no formal seed program in Asia supplying more than 5% of the annual seed requirements. Farmers either produce their own seed or get it from other farmers. Allowing for this informal system and the farmers' average rate of seed renewal, it is estimated that the annual demand for seed potatoes in South East Asia will approach 31,900 tonnes. In reaching this figure, the following issues were also considered.

Seed rate

Many have calculated the annual seed requirement by multiplying the number of hectares planted by the seed rate per hectare. However even this simple calculation is difficult in Asia because there is little accurate information on the total area planted. There are large numbers of small landholders who cultivate small areas of potatoes within a diverse mixed cropping enterprise.

Seed rates in Asia are usually much lower than in Australia. This is because seed is scarce and it is expensive. To further reduce the cost, seed is often cut. In the Philippines it is estimated up to two thirds of potato farmers use cut seed and in Thailand, farmers have reduced the seed rate to about 0.5 tonnes/ha. In the tropical lowlands the seed rate may be up to 50% more than that used in the highlands.

Influence of ware market prices

Often prices on the ware market will determine how much seed the farmer will retain. Normally farmers keep the smaller tubers for seed, but there is a switching price above which the farmers may decide to sell all of the crop to the ware market and to buy in seed at a later date. This decision will be influenced by the seed storage facilities the farmer has access to and the anticipated losses during storage.

Cost of seed

Seed is the most expensive input for producing potatoes in South East Asia. Few farmers have the capital resources to purchase large quantities of seed. The availability of finance and the cost of finance will influence the demand for seed.

If the farmer is a member of a government approved seed scheme or a co-operative farmer group, low interest loans may be available. Alternatively if the farmer is under contract to a processing company, the seed and other inputs may be supplied. In other cases, farmers are forced to make private arrangements with wholesalers and traders, with repayment at harvest.

Where there is a well-developed market and production and ware prices are relatively stable, there is a higher rate of improved seed use.

Seed degeneration

In Asia, the rate of seed degeneration is more rapid than in temperate zones because the insect populations are higher, there are more potential sources of infection and seed storage is more difficult.

Potato farmers in the lowlands are more likely to renew their seed more frequently because the yield difference between imported seed and the seed saved from their previous crop is much greater.

Conversely, because the rate of seed degeneration is lower in the highlands, farmers are more likely to retain their seed for a longer period. Where the yields are low, it is more difficult to justify the use of high quality seed. In much of Asia, it is often more profitable for farmers to use poor quality seed.

Seed productivity

To yield well in the tropics, a variety must be able to cope well with the higher temperatures, higher humidity, shorter daylengths, shorter growing period, higher levels of pests and diseases and grow well with only minimal inputs. The variety must also have a good storage capability and fit into the window of opportunity in the cropping season.

In much of Asia, early maturing varieties are preferred because it is possible to achieve multiple crops per year.

Import barriers

Import quotas and quarantine restrictions apply in many South East Asian countries. Consequently the effective demand will be much lower than that calculated.

A report called "*A review of the Export Market for Western Australian Seed Potatoes*" may be obtained from Terry Laidler of Agriculture WA. (08) 9368 3640. Cost $11.00 includes postage and handling. ■

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Fresh potatoes - national consumer research

To assist in the development of the Potato Industry Strategic Plans the APIC R&D Committee initiated a survey of consumers which was carried out by Harrison Market Research who were commissioned by Richard Strategic Services.

The aims of the survey were; (1) to identify and quantify (from the consumers' perspective) any particular issues, problems or opportunities that might be addressed through the R&D program and (2) where possible, compare results with consumer usage and attitudes market research conducted in 1993 and highlight changes that have implications for the R&D program.

These implications are shown in italics at the end of each section.

The potato industry is in the business of satisfying consumers and it is therefore important to know what they think about potatoes.

The study involved random telephone interviews of 500 'Main Grocery Buyers' in both metropolitan and country areas in January 1998. It differs from the work done in the 1993 study in that there were 500 fewer interviews, all states and country areas were included (only Sydney, Melbourne and Adelaide in the 1993 study) and not all the questions asked were the same. Comparisons can still be made if these differences are kept in mind.

Who buys fresh potatoes

The 'Main Grocery Buyer' in each research household was interviewed. The split between male and female is as follows.

	This study	1993 Survey
Females	**80%**	85%
Males	**20%**	15%

The trend to more males doing the grocery shopping is consistent with other retail studies.

Potato Marketing and R & D programs need to take into account the trend towards more males doing the grocery shopping.

Where they buy

While the difference in methodology and sample between the two studies may influence the results to some degree, there appears to be a strong, and increasing, bias to supermarket purchase.

	This study	1993 Survey
Supermarkets	**64%**	49%
Greengrocer etc	**30%**	48%
Other	**6%**	3%

There is every possibility that the trend to supermarket purchase will continue. Therefore R & D and marketing programs that seek to influence or involve the retail sector will need to be tailored accordingly.

What do they buy?

The differences between the studies were probably not significant due to the way the two studies were carried out.

	This study	1993 Survey
Packaged	**40%**	Question not asked
Loose	**58%**	Question not asked
Washed	**57%**	48%
Brushed	**21%**	26%
Dirty	**19%**	26%

A significant number of consumers continue to show a clear desire for 'clean' potatoes. This has implications for the Breeding Program in areas such as appearance and keeping quality after washing. It also impacts on R & D into areas such as packaging, storage and consumer information.

Knowledge of varieties

When asked to name the variety they usually purchase, the vast majority of respondents were not able to name the variety. The only variety mentioned with any significance was "Pontiac" (12%). Most other answers were generic in nature, such as "washed", "brushed", "dirty", "pink/red ones" and "small ones".

Just over one-fifth (21%) said they "do not know" what variety they normally buy.

These findings are much the same as the results in 1993.

Consumers' lack of knowledge about varieties is particularly relevant for any R & D activity designed to provide consumers or retailers with product information. This issue is also important for marketing including packaging, promotion and point of sale activities.

Problems buying potatoes

Almost one quarter of all respondents reported problems in "getting what they want" when they go to buy potatoes. The incidence was higher in country areas (28%) compared to metropolitan (18%). More than a quarter of the problems identified related to the quality of potatoes. The problems mentioned included "damaged/bruised cut", "soft", "smelly" and "green". Of those who said that they have problems "getting what they want when they buy potatoes", their reported frequency of the problems was:

	How often
"Almost all the time"	**23%**
"Pretty frequently"	**18%**
"Sometimes"	**41%**

So over 40% of people who have problems getting what they want when they buy potatoes say this happens "pretty frequently", or more often.

The extent of these problems should be of serious concern to any food producer. For potatoes, the situation is compounded as it is unlikely replacements/competitors such as pasta and rice suffer the same sort of problems.

The relatively high incidence of problems associated with product quality suggests a need for better quality control systems from grower to retail.

The higher incidence of problems in country areas may be the result of a number of factors including; more potatoes consumed, longer transport times, longer storage times in supermarkets and consumers purchasing more potatoes, less often.

Problems storing potatoes

More than a quarter of respondents report they have problems with potatoes when they store them. Over half of those experiencing problems say "they sprout". Other problems prominently mentioned include "go off", "go soft" and "go green". The reported frequency of storage problems was:

	How often
"Almost all the time"	**5%**
"Pretty frequently"	**22%**
"Sometimes"	**41%**

So, over 25% of those saying they have problems storing potatoes say this occurs "pretty frequently", or more often.

There is a case for a concerted education program to encourage consumers to handle and store potatoes in a way that will maximise quality and life.

It is possible that the impact of poor handling and storage from grower to retailer may affect the product purchased by the consumer. This may not show up until after the consumer gets the potatoes home.

There is a need for a properly structured and comprehensive quality system.

Problems cooking potatoes

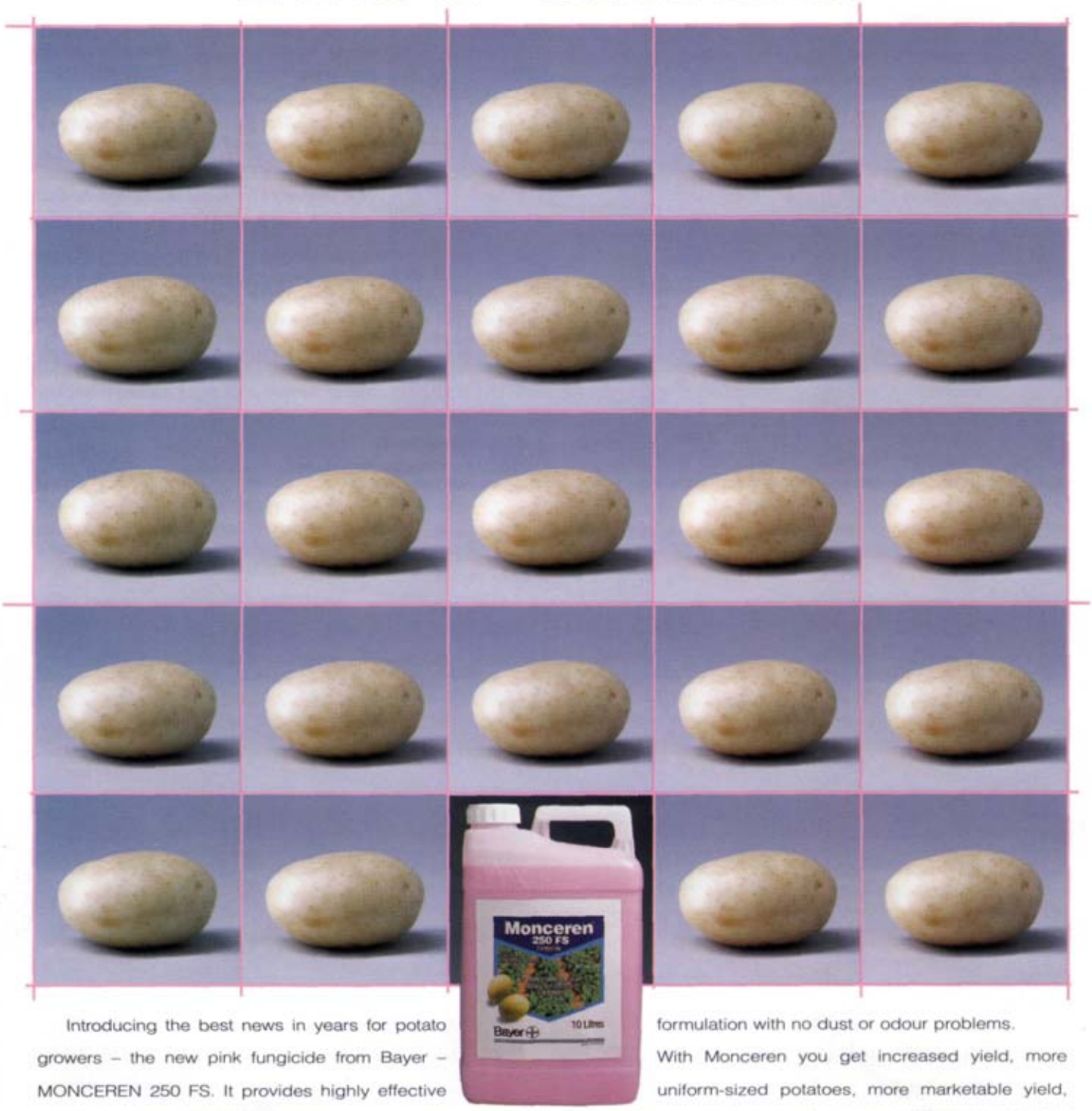
A minority of respondents reported problems when they cook potatoes. Most problems related to the cooked potato not turning out as expected (ie not browning, breaking-up when boiled etc).

Consumer product information and marketing activities need to ensure that the issue of 'variety choice for cooking occasion' is adequately covered.

Acknowledgements

This report was commissioned with funds from HRDC.

More spuds Not duds



Introducing the best news in years for potato growers – the new pink fungicide from Bayer – MONCEREN 250 FS. It provides highly effective control of seed borne *Rhizoctonia solani* (stem canker and black scurf) in potatoes every time. So MONCEREN increases your proportion of clean, marketable-size tubers. MONCEREN is a convenient, easy to use flowable formulation with no dust or odour problems.

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Black nightshade in potatoes

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Black nightshade *(Solanum nigrum)* is estimated to be a problem in at least 80% of potato crops planted in non-virgin paddocks.

It is estimated that the weed causes yield losses of up to 5% due to competition, and may cause further losses by acting as a host plant for several potato diseases, such as black dot.

Research of the control of black nightshade in potatoes has continued over the 1997-98 season. As part of a three year HRDC funded project conducted by Serve-Ag Research, trials were conducted in Manjimup (WA), Mt Gambier (SA), Atherton Tableland (Qld) and Tasmania.

These trials were set up to determine the crop tolerance to the herbicides of more susceptible varieties, including the crisping variety *Atlantic*, processing variety *Shepody* and the fresh market variety *Bison*, on a range of soil types. Good tolerance with *Russet Burbank* and *Kennebec* varieties has been determined in earlier trials. Experimental products were included in mixes with currently registered products in order to improve the weed spectrum.

Results from the initial assessment of these trials indicate that treatments including the products F6285, SAN 582 and clomazone (Command) provide the greatest levels of weed control in mixtures with currently registered products such as Gesagard, Bladex and Lexone.

Tank mixes of Command with Lexone, Gesagard or Bladex enable rates to be reduced, particularly on lighter soils. Weed spectrum is improved with these mixes and residual control is provided.

With the pending registration of clomazone as Command in late 1998, continuing trials will look at the development of strategies that include this product, and integrate its use with current production practices and products using grower demonstration trials.

Command is used strictly pre-emergence, does not require watering in and is compatible with a range of industry standard products in tank mixes, to improve its activity spectrum. The product is most active when applied to dry soil and there is minimal soil disturbance following application. When applying, proximity to susceptible plants needs to be considered.

It is expected that the Command label will be extended in the near future to include those grasses on which it has activity.

Acknowledgements
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IPM in North Queensland

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Growers involved in the Sustainable Crop Management of Potato Farms on the Atherton Tablelands project are moving steadily towards a full IPM program.

Better known as LAPDOG and TOPCAT these groups, in collaboration with QDPI and local crop consultants, have determined which are their major insect pests and identified when these pests are of economic concern.

These insect pests include heliothis, cluster caterpillar, green peach aphid and potato tuber moth (PTM).

These pests are known to have natural predators. Shield bugs attack cluster caterpillar and heliothis, brown smudge bugs attack aphids and caterpillars, whilst wasps of the genus *Aphidius* attack aphids. *Orgilus lepidus* and *Copidosoma desantisi* wasps will attack PTM if introduced.

The growers now face the problems of obtaining predators when required, and understanding how they will operate in the Tablelands environment.

The growers have successfully approached QDPI and James Cook University, who are now jointly funding a project to help further develop the IPM programs.

The project will initially develop the production of shield bugs and *Aphidius* wasps, monitor the release of the natural predators and their effects on pests in released fields, and compare the results of IPM versus traditional insect spray approaches.

It is hoped at a later stage to produce brown smudge bugs and *Copidosoma* wasps, as additional weapons for the growers' IPM armoury.

Department of Natural Resources & Environment - Agriculture Victoria

✔ **A Date for Your Diary**

National Potato Field Day
18 February 1999
at the Institute for Horticultural Development - Toolangi

Further information: Tony Allen IHD

(03) 9210 9222 Fax (03) 9800 3521

POTEX

- an opportunity for improved seed potato production

Good stolon production from a Potex plantlet

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Wrightson Seeds has secured access to Potex technology for the production of high quality seed potatoes.

This technology was developed in the United Kingdom and has been commercially tested there and also in the USA.

With the contracted assistance of Agriculture Victoria a successful test run of the Potex technology was done at the Potato Research Station, Toolangi and with the assistance of some leading seed potato growers at several field sites.

The test run showed that the system can generate large numbers of minitubers but its main benefit is the cost efficient production of large numbers of field-ready plantlets for direct mechanised transplanting into the field. With appropriate management these plantlets have the capability of setting good numbers of nucleus seed tubers for conventional field harvest

The Potex system offers a flexibility that is not achievable in other rapid multiplication systems. With plantlets it is possible to be field ready within just a few weeks of commencement and there are no dormancy issues to take into consideration that occur with minitubers. Minitubers can also be produced "out-of-season" and banked for future use. This dual opportunity adds security to the production system.

The test-run

With the help of Transplant Systems Ltd plantlets were transplanted in one to two hectare blocks in South Australia and in Victoria. Four locations and four varieties were used in the test run. The trial work allowed for the effects of variety, location and seed grower practices to be assessed in relation to the technology to determine future directions. A fully mechanised system of transplanting was also tested which will have considerable future potential.

Planting at Warragul, Victoria with a fully automatic transplanter

Transplanting potatoes requires different grower skills to those usually needed for seed potato production but are similar to the skills and inputs utilised in other transplanted horticultural crops.

The season proved to be a very testing one and the successes achieved provided much important information on how to commercially develop the technology.

Average tuber set was approximately 10 to 15 tubers per plant which gave an acceptable yield based on both weight and tuber number. The seed tubers harvested were very high quality and will be replanted next season to produce a G2 certified seed crop.

The test run showed that the technology offered considerable benefits over the existing system of seed potato production with the potential to produce high yields and numbers of quality seed potatoes. The trials enabled production protocols to be developed as a preliminary to successful commercial establishment of the technology.

Commercial development

A fully commercial Potex production centre is now being developed by Wrightson in South Australia and production centres in other potato production regions of Australia will follow.

The linkage of Potex technology to superior proprietary varieties will form the basis of an integrated Wrightson business dedicated to the supply management of potatoes for export, supermarkets and processors to meet their increasing quality requirements. ■

The potential for limited generation seed potatoes

Potato growers are increasingly demanding better control of seed-borne diseases such as silver scurf (*Helminthosporium*), black dot (*Colletotrichum*) and black scurf (*Rhizoctonia*). Seed cost is a significant component of potato production and therefore the investment made in it needs to have good guarantees of productivity.

The solutions to enhancing seed potato quality are the use of clean land and the adoption of limited generation seed potato production technology. Some proactive seed potato growers are already seeking new land to meet the market requirements and technology providers are commercially developing limited generation production facilities.

The aim of new technologies like the Potex system is to massively increase the production of early generations under controlled conditions and to minimise the number of field generations subsequently required for the production of seed potatoes.

Reduction in generations results in less exposure to potential disease problems. It is certainly now possible to eliminate one field generation (to produce G3 certified seed) whilst maintaining the current level of economics. Better quality would be achievable with the elimination of two field generations (G2 certified seed) but with a cost for this improvement.

Although there will be some limitations to the supply of clean land there are areas that can be developed for seed potato production but it will be essential to safeguard their long term potential by keeping them clean.

New technologies can play an important part in this and limited generation seed potato production should become the industry standard within the next few years.

Changes will be required to the infrastructure of the seed potato industry and to the certification procedures to adopt these advances. ■

Tomato spotted wilt virus in seed potatoes

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With the introduction of western flower thrips to Australia it is feared that tomato spotted wilt virus (TSWV) epidemics in potatoes may escalate as these thrips are far more efficient at virus spread than those currently implicated and are notoriously difficult to control.

In response a national team has been established to develop strategies for the management of western flower thrips (WFT) and TSWV in a range of horticultural crops.

The focus of the project is to determine the risks and effects of TSWV epidemics on seed potato production.

We know that virus transmission from the plant top to tubers can be inefficient, the significance of this to seed growers, especially in light of certification standards, will be examined.

We will also look for virus, plants from which the disease can be spread, and disease spread patterns to better understand how virus epidemics occur and how they may be best prevented.

What is tomato spotted wilt virus

Tomato spotted wilt (TSWV) is a virus capable of infecting a huge range of plant species (> 900 species in over 70 plant families). It is spread by seven species of thrips, five of which are recorded in Australia.

The virus causes sporadic but economically important outbreaks in Australian seed potatoes. For example, in the 1996-97 season some seed crops in Tasmania's southern and north-eastern seed districts had up to 26% TSWV infection and failed certification. Consumer confidence now threatens the sustainability of these seed areas.

Symptoms

Symptoms on potato plants may vary with the variety of potato, strain of the virus and age of the plant when infected. Typically there are dead spots or rings on leaves and on the stem. Often only a few stems show symptoms. Death of infected shoots or plants may result.

These symptoms resemble early blight (target spot), but can usually be distinguished on the basis of where symptoms predominate on the plant. TSWV symptoms first appear in the young foliage whilst early blight infections initiate in older leaves. Confirmation of TSWV infection can be done using laboratory testing.

Tuber symptoms vary with cultivar. Sensitive cultivars (like *Shepody*) can show sunken black dead spots or rings visible on the tuber surface and severe internal symptoms varying from dark shadowing to large dead spots within the tuber.

Less sensitive cultivars (like *Russet Burbank*) may show little or no obvious symptoms of infection with only occasional internal flecks and no external symptoms.

Tubers from infected plants may also show growth distortions (secondary growth and poorly filled heel ends) due to poor growth of the plant following infection regardless of whether tuber carries the virus or not. *Russet Burbank* is particularly prone to this.

Virus transmission by seed cutting

It was feared that seed cutting could aid the spread of the virus from infected tubers to healthy tubers as occurs with some other potato viruses.

In a trial TSWV contaminated knives were used to cut seed tubers of both *Russet Burbank and Shepody*. There was no evidence of transmission in either cultivar despite the heavier than expected disease present in infected tubers.

Can TSWV be spread by planting infected tubers

This work demonstrated that tubers from infected plants do carry the disease and this leads to infected plants in the subsequent crop. However, the amount of disease transmitted varies considerably depending on the cultivar.

Only 32% of tubers from infected plants of *Russet Burbank* showed the virus compared with 84% of tubers from *Shepody* plants. Furthermore when these infected tubers were grown on, only 20% of *Russet Burbank* plants were infected compared with 78% of *Shepody* plants.

TSWV symptoms in *Shepody*

TSWV symptoms in *Russet Burbank*

Obviously choice of cultivar is an important disease management option. But there are also important implications of these findings for seed growers in that the current certification standards for TSWV may not reflect the actual risk to the seed purchaser.

For example, if a *Russet Burbank* seed producer's crop had 6% TSWV infection (unacceptable on current standards), the harvested seed may actually contain only 2% virus (assuming 32% transmission rate is a consistent figure). Furthermore, if this 2% infected seed was subsequently planted it may give rise to only 0.4% infected plants in a subsequent crop, obviously within the acceptable thresholds for certification. If the seed crop was Shepody however, and the same assumptions hold, then the seed would contain around 5% infected tubers and the subsequent crop about 3% infected plants.

There might therefore be a case for relaxation of the certification guidelines for certain cultivars at least (like *Russet Burbank*). However this assumes that the field inspections for TSWV infection are accurate and that the rate of transmission from infected plants to tubers and from tubers to new plants is consistent within certain cultivars.

Further trials will test these assumptions. This study will evaluate a range of important Australian cultivars (including *Atlantic, Coliban, Desiree, Kennebec, Russet Burbank,* and *Shepody*).

Patterns of virus spread

TSWV, unlike many of the major potato viruses, commonly enters the crop from external sources. Observations of infection patterns show most infection occurs around crop edges particularly where weedy areas are present. These weeds or other alternate hosts act as reservoirs for the virus and breeding grounds for the thrips. Careful management of weeds surrounding crops is essential for good virus control.

Certification is also important as virus transmission to tubers, although inefficient, will provide sources for subsequent virus spread if thrips are not managed within crops.

Climatic conditions also play a major role in disease incidence with warm and moist conditions favouring thrips breeding and survival of other plants from which the disease can be spread.

Acknowledgements

This work is part of the national strategy for management of western flower thrips and tomato spotted wilt virus funded by HRDC and numerous industry contributors.

Increase profits with new varieties

National Potato Improvement & Evaluation Scheme

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The varieties now coming out of the National Potato Improvement & Evaluation Scheme (NaPIES) have improved consumer appeal, higher yield or increased recovery through processing plants.

These benefits will help industry increase market share and improve efficiency, thus providing greater profitibility for all sectors of the industry.

This article reports on the results of large commercial test plantings of new varieties during the 1997-98 season. These large scale plantings confirm results from smaller trials and they are a vital step in demonstrating the potential of new varieties.

The varieties have been bred or imported through the National Potato Improvement & Evaluation Scheme (NaPIES). The NaPIES program also contributes funds for regional district trials. Other funds for the trials come from the state agricultural agencies and growers.

***MacRusset* and *Russet Burbank* harvested at Ballarat, Vic**

Doug Lancashire, potato grower from Ballarat with the variety *MacRusset*

The varieties tested often differ in performance depending on the region in which they are grown. This highlights the importance of a national evaluation network like NaPIES.

FRENCH FRY

89-27-33 MacRusset

MacRusset was selected from trials in Victoria, South Australia and Tasmania where it has produced higher yields and less misshapen tubers than Russet Burbank. Hollow tubers or brown centre are not seen in MacRusset. Plants are vigorous with some resistance to target spot disease. The growing period is about 2 weeks longer than Russet Burbank and plants are more susceptible to powdery scab.

Average of 17 replicated trials in Tas, SA and Vic

Variety	Yield of fry grade tubers more than 100g (t/ha)	Dry matter (%)	Fry colour score scale: 1-10 (more than 7 is too dark)
Russet Burbank	58.5	20.8	6.4
MacRusset	68.7	21.2	6.7

MacRusset was tested in small commercial plantings at Ballarat and Mt Gambier totalling 7 hectares in conjunction with McCain and SAFries this season. In general *MacRusset* out yielded *Russet Burbank* by 10-20% and had much more even tuber shape with less knobby and hollow tubers.

A factory production run of 230 tonnes at McCain, Ballarat indicated that powdery scab, blackspot bruise and fry colour were worse for *MacRusset* than *Russet Burbank*.

MacRusset was also tested in small commercial plantings throughout northern Tasmania by Simplot and McCain this season. Here *MacRusset* had higher yields and better processing recovery rates than *Russet Burbank* due to more even shaped tubers with less internal defects.

About 40 tonnes of seed will be used in a co-ordinated testing program with McCain and SAFries this season in Victoria and South Australia.

***Sleeping Beauty* tubers showing blocky shape and uniform size**

89-19-2 Sleeping Beauty

This variety has been selected in WA but trials in other areas indicate it may have wider potential. The benefits of *Sleeping Beauty*, as a supplementary variety to *Russet Burbank*, are higher yield, higher dry matter and lighter fry colour with better tuber shape. The results are consistent in 10 trials across Australia.

Sleeping Beauty sets less tubers than *Russet Burbank* and this helps ensure tubers meet factory size requirements. Rhizoctonia seems less of a problem and internal and external tuber defects are lower for *Sleeping Beauty* than *Russet Burbank*. Storage quality of *Sleeping Beauty* has also proved to be outstanding.

In seven Victorian storage trials *Sleeping Beauty* cooked consistently lighter than *Russet Burbank* and after storage at 10ºC for up to 10 months.

Average of 10 replicated main crop trials in Vic and WA

Variety	Yield of fry grade tubers more than 100g (t/ha)	Dry matter (%)	Fry colour Score scale: 1 - 10 (more than 7 is too dark)
Russet Burbank	45.1	20.7	5.0
Sleeping Beauty	53.3	22.3	3.7

These yield and dry matter benefits show the potential for increased profits to growers. Using the average trial yields and a price of $185 per tonne plus bonuses for dry matter the net profit of *Sleeping Beauty* will be $2,756 per hectare, much more than the *Russet Burbank* net profit of $580 per hectare. The break-even cost per tonne of *Sleeping Beauty* is $134/tonne compared with *Russet Burbank* at $162/tonne.

Sleeping Beauty performs well on sand out-of-season. Yield and dry matter are higher than both *Kennebec* and *Shepody* and more fries cook to the lightest colour grade.

Average of four replicated early crop trials and demonstrations in WA

Variety	Yield of fry grade tubers more than 100g (t/ha)	Dry matter (%)	Fry colour % of fries in lightest colour grade shown
Kennebec	35.6	19.4	70
Shepody	29.2	21.2	58
Sleeping Beauty	49.2	22.3	78

Legend (C0083008-1) & Umatilla Russet (A082611-7)

These varieties have been selected for further evaluation by Tasmanian processors from trial work carried out in Tasmania and Victoria. These two varieties have produced higher yields and less misshapen tubers than *Russet Burbank* in trials carried out over the last few years.

Average of nine replicated trials in Tasmania and Victoria

Variety	Yield of fry grade tubers more than 100g (t/ha)	Dry matter (%)	Fry Colour Score scale: 1-10 (more than 7 is too dark)
Russet Burbank	58.6	21.7	5.1
Legend	64.8	21.6	5.2
Umatilla Russet	62.7	20.6	5.5

Internal defects such as hollow heart and brown centre are not seen in these varieties and tuber shape is more even than *Russet Burbank*. However *Umatilla Russet* does display a predisposition to tuber elongation (second growth) when subjected to water stress in hot weather conditions. The growing period for *Legend* is similar to that of *Russet Burbank* while *Umatilla Russet* has a shorter growing period of about one week.

Both of these varieties were tested in small commercial plantings throughout northern Tasmania by Simplot and McCain this season. In general, results indicate that *Legend* and *Umatilla Russet* have promise as supplementary varieties to *Russet Burbank*, providing increased profitability. This is due to the increased yields and better recovery, when processed, from more even shaped tubers with less internal defects than *Russet Burbank*.

Leon Hingston sampling new varieties at Stowport, Tasmania

FRESH MARKET VARIETIES

90-40-1 Ruby Lou

Ruby Lou has been selected from trials in different production areas across Australia. *Ruby Lou* has round evenly shaped tubers with light red coloured skin and is suitable for the red skin fresh potato market. *Ruby Lou* has smooth skin which does not scuff when handled and cooking quality is multipurpose, suitable for frying or boiling, with excellent flavour.

Average of four trials using cool stored seed, Vic, Qld, WA (No.1 grade yield 80-450g tubers)

Pontiac	54.9 t/ha	*Ruby Lou*	43.3 t/ha

Average of two trials using kept seed to plant mid summer, NSW and SA
(No.1 grade yield 80-450g tubers)

Pontiac	32.4 t/ha	*Ruby Lou*	34.1 t/ha

Ruby Lou has short tuber dormancy, fast plant growth and early tuber bulking making this variety suitable for the Riverina, Riverlands and Swan Coastal Plain where two crops per year are grown.

The advantages of *Ruby Lou* over *Pontiac* are that the red skin colour does not fade quickly after plant senescence and *Ruby Lou* is resistant to skin scuffing and tuber shatter when handled in cold conditions. This means that *Ruby Lou* will give good pack-outs.

In tests by the Potato Marketing Corporation of Western Australia (Western Potatoes), four growers delivered in September to October. Here *Ruby Lou* produced reasonable yield and very good pack-outs with an average of 84% Grade 1. Two other growers delivered in January and yield was as high as *Delaware* and *Nadine* from the same site and Grade 1 pack out was 69%.

Ruby Lou planted along side *Foxton* at this time showed better skin quality. Scurf was a problem and so it will be important to harvest this variety promptly from 'scurfy' sites.

About 18 hectares was grown in trial plantings in production areas last season and 100 tonnes of seed will be available in Victoria and Western Australia for planting this coming season.

90-105-14 Shine

Shine was selected from trials in Victoria, New South Wales and South Australia where it has produced high yields of smooth, white skinned tubers suitable for the washed fresh market. *Shine* has smooth, bright white skin with small lenticels and has excellent boiling quality and good flavour. *Shine* is resistant to Potato Cyst Nematode (Ro1).

Average of two trials using cool stored seed Victoria
(t/ha No.1 grade yield, 80-450g tubers)

Sebago	49.4	*Coliban*	47.5	*Shine*	48.7

Neil, Parry and Trevor Eardley-Wilmot picking up fresh market varieties at a demonstration in their July planted crop near Myalup, WA

Shine has short tuber dormancy, fast plant growth and early tuber bulking, similar to *Sebago* and early maturity, similar to *Pontiac*, making this variety suitable for the dual cropping/kept seed areas of the Riverina and Riverlands.

Average of three trials using kept seed to plant in mid summer, New South Wales
(t/ha No. 1 grade tubers 80-450g)

Sebago	31.6	*Coliban*	13.2	*Shine*	27.3

About 8 hectares were grown in trial plantings in production areas last season and 80 tonnes of seed will be available in Victoria for planting this season.

90-105-16 Winter Gem

Winter Gem was selected in trials in Western Australia where it has produced good yields of round, smooth skinned, white fleshed tubers. Its best performance has been in winter plantings where its tolerance of powdery scab and storm damage could be most useful to industry.

In tests with Western Potatoes, three growers delivered 30 tonnes of *Winter Gem* to packers last season. In the earliest planting skin quality was disappointing due to abrasions. It looks as though *Winter Gem's* soft skin may require a longer time to set firmly enough for commercial harvesters. A later June planting produced tubers with firmer skin.

It's exciting that *Winter Gem* yielded as well as *Spunta* in winter and had a better pack-out than *Delaware*. This indicates potential for *Winter Gem* to be a more profitable winter variety than current standards.

Average pack-out by grade and yield of *Winter Gem* in autumn commercial plantings harvested from September to October 1997 in Western Australia
(Data supplied by Western Potatoes)

Variety	Grade by percent.			Total yield
	Premium	Grade 1	Grade 2	(t/ha)
Delaware	2	67	17	47
Spunta	30	48	10	38
Winter Gem	12	57	8	40

Mondial

Mondial is a Dutch variety that has been selected in trials in Western Australia. It produces high yields of large, oblong tubers with pale yellow skin and flesh. *Mondial* is resistant to potato cyst nematode.

Mondial has potential as a replacement for *Spunta* but with an extended production window. It is good for salads and for microwaving and acceptable for mashing. It is not recommended for frying as colour is dark and French fries are soggy.

Mondial is undergoing commercial tests with Western Potatoes. These tests involve three years of increasing production by the same growers which gives them experience with the variety while supplying controlled amounts to the packers, retailers and consumers to gauge their reactions.

Nine growers tried *Mondial* last season and they delivered about 200 tonnes to packers. The pack-outs from winter crops were similar to the standard varieties grown at the same sites. Yield was substantially higher than *Delaware* and *Spunta*.

Problems encountered included too many oversize tubers and poor skin set. Growers of winter trials have all ordered more seed and a better performance is expected next year after refinements to spacing, fertiliser and crop husbandry are made.

Mondial is protected by Plant Breeder's Rights and the

Australian agent is Sunrise Agriculture Pty Ltd.

Average pack-out by grade and yield of *Mondial* in winter commercial plantings harvested from October to December 1997 in Western Australia (Data supplied by Western Potatoes)

Variety	Grade by percent.			Total yield
	Premium	Grade 1	Grade 2	(t/ha)
Delaware	16	61	13	52
Mondial	9	70	15	62
Nadine	10	62	17	28
Spunta	9	65	13	55

Two growers tested *Mondial* in later plantings in spring and summer. The results were not as good with the tubers being large with poor uniformity of shape. Some breakdown was observed. The pack-out and yield figures indicate that further testing is warranted.

Average pack-out by grade and yield of *Mondial* in spring commercial plantings harvested from January to March 1998 in Western Australia (Data supplied by Western Potatoes)

Variety	Grade by percent.			Total yield
	Premium	Grade 1	Grade 2	(t/ha)
Mondial	0	67	34	59
Spunta	4	61	22	59

92-19-4

This variety has shown promise as a fresh market variety for Queensland, particularly North Queensland. Superior yield and excellent skin colour and brightness make this variety a possible candidate to compete successfully with *Sebago* in both the general fresh market and in the washed trade.

Yield from 1997 demonstration trial at Kairi Research Station in Queensland

Variety	Fresh yield (t/ha)	Dry matter (%)	Tuber number per plant
Sebago	33.7	17.7	6
92-19-4	61.3	18.7	6

CRISPS

90-7-17 Crispa

Crispa was selected from trials in Victoria and New South Wales where it has produced high yields of small round tubers for crisp processing. *Crispa* has dry matter content similar to *Atlantic* and very light crisp colour even after long term storage.

Crispa produces about twice as many tubers per plant as *Atlantic* and therefore can produce high yields of small tubers preferred for crisp processing.

Average of five replicated trials in Victoria

Variety	Yield of crisp grade tubers 50-430g (t/ha)	Tuber number per plant	Dry Matter (%)	Crisp colour scored 1-10 more than 6 too dark
Atlantic	56.1	6.7	21.2	4.3
Crispa	57.5	15.1	21.1	5.1

Crispa was tested in small commercial plantings totalling five hectares in conjunction with the Smiths Snack Food Company and Frito Lay this season.

Crops of the new variety which were planted at slightly wider spacing than *Atlantic* and irrigated through the whole of the growing season produced very high yields of medium sized tubers. Preliminary tests of these trials by the crisp companies have shown high dry matter content and acceptable processing quality of the new variety

About 30 tonnes of seed of *Crispa* will be used in a co-ordinated testing program with the two companies this season.

EXPORT

86-31-5 White Rhino

This variety continues to perform well in trials in North Queensland. It has been found to be acceptable in parts of South East Asia in both the fresh market and as a processing potato.

It is comparable with *Sebago*. It produces a slightly russeted white skin tuber with similar shape to *Sebago*. Its acceptance in South East Asia indicates good export potential. Seed of this variety is currently being produced for large scale plantings in North Queensland.

Average of four replicated trials and demonstrations in Qld

Variety	Fresh yield (t/ha)	Dry matter (%)
Sebago	45.3	17.7
White Rhino	52.3	18.3

Conclusions

The trials and commercial plantings of these new varieties have shown major advantages over existing commercial varieties which will result in increased returns to growers and processors as well as providing benefits to consumers. The superior performance of the new varieties is a result of the extensive, regional selection procedure of the NaPIES scheme.

Acknowledgements

We would like to thank growers, processors and potato packers who have helped with variety testing and we gratefully acknowledge HRDC. The Potato Growing Industry Trust Fund of WA has also supported work in WA.

Harvesting a variety trial at John Doyes, Berrigan, NSW

Potato variety field days

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As part of the NaPIES project, a series of field days were held across Australia during 1997-98 to demonstrate to farmers how new varieties perform when grown in local potato growing areas.

Recently released varieties, varieties from the National Australian breeding program at Toolangi and new varieties imported from overseas were grown in demonstration plots within commercial potato crops.

These field days were well attended as it gave growers, packers and processors the opportunity to see how new varieties compared alongside standard varieties when grown under commercial conditions.

The field days were held at Crookwell (NSW), Virginia (SA), Gatton (QLD), Manjimup (WA), Ulverstone (TAS) and Thorpdale (VIC).

Some of the promising new varieties shown at some of the field days included:

Crisp processing

Crispa - a new crisp variety from the Australian breeding program

Fresh market

Red Ruby and Fontenot - Red skin fresh market varieties from the USA.

Ruby Lou - a new red skin fresh market variety from the Australian breeding program.

Shine - a new white skin fresh market variety from the Australian breeding program.

Roger Kirkham discussing the characteristics of new varieties at the Potato Variety Field Day

French fry processing

MacRusset and Sleeping Beauty - French fry varieties from the Australian breeding program.

Legend and Umatilla Russet - French fry varieties from the USA.

This coming season there will be a similar demonstration of new varieties grown in one selected production area in each state allowing the potato industry to compare new varieties when grown under commercial conditions.

We would like to thank the growers who had the field days on their properties. ■

Disease levels of seed used in SA

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A new survey shows a high level of disease in seed tubers used in South Australia. This is a major concern with potato growing moving into new areas.

In South Australia, increased potato production and the demand for clean high quality potatoes has resulted in the expansion of the industry into areas that have not grown potatoes before. However, there are concerns that the increase of tuber and soil borne diseases within these areas has resulted from the introduction of seed tubers carrying these pathogens.

To determine the extent of the problem a survey was conducted on tubers imported into South Australia as seed potatoes.

A sample of 100 tubers collected at random from bins of potato tubers intended for planting in 1997-98 was taken from 37 growers. Growers were selected at random with no particular bias in respect to seed source or variety. Tubers were tested only where the origin of the seed lots could be identified and was accompanied with a certificate of registration.

The results given in the table show that *Rhizoctonia* and *Verticillium* were present in most of the samples tested. The incidence of silver scurf was in most cases higher than that of black dot. Although powdery scab was detected in some seed lots the level was very low compared to other diseases.

Although many of the diseases are not included in certification schemes, the fact that high levels of diseases were found should be of concern to the industry. Infected seed tubers are the main means of spreading diseases, particularly into new areas or into paddocks that have never been planted to potatoes.

The potato seed industry needs dramatic changes to improve the seed quality as these results suggest that soil in many seed production areas is infested with a wide range of potato pathogens.

Acknowledgments

We thank HRDC for funding this work and the potato growers who donated the tubers for examination.

INCIDENCE OF DISEASES ON CERTIFIED SEED TUBERS USED IN SOUTH AUSTRALIA IN 1997-98

	Cultivar and source	No. of growers	Disease incidence (% of tubers infected)				
			Rhizoctonia	*Black dot*	*Silver scurf*	*Powdery scab*	*Verticillium*
NSW	*Atlantic*	1	70	1	5	1	3
	Coliban	4	39	23	52	0	34
Vic	*Atlantic*	5	21	26	47	0	9
	Break light	1	0	0	76	0	0
	Bison	1	17	18	77	5	2
	Coliban	9	22	44	62	0.5	5
	Crystal	5	31	19	48	1.8	9
	Desiree	4	10	10	70	0.3	8
	Exton	1	74	42	64	0	17
	Kennebec	3	54	10	34	1	15
	Pontiac	1	8	64	94	0	13
	Red La Soda	2	9	3	80	0.5	2

Two WA seed growers achieve SQF 2000^{CM} accreditation

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In May 1998, two Western Australian certified seed growers became the first in Australia to achieve SQF 2000^{CM} accreditation.

Tom Fox of Lake Jasper Certified Seed Potatoes and Lindsay Radomiljac of Northcliffe Certified Seed Potatoes said their businesses have already benefited from having a Quality Assurance (QA) system in place and they are confident they will continue to see improvements in all areas of operation.

These accreditations form part of an industry-wide initiative by the Potato Marketing Corporation of Western Australia, Western Potatoes, to introduce QA into the potato industry.

This initiative has already resulted in a WA washpacker becoming the first to achieve SQF 2000^{CM} Quality Code Accreditation. A number of ware potato growers and a transporter are also expected to be accredited by September 1998.

Between them, Tom Fox and Lindsay Radomiljac have over 50 years experience in the potato industry, but have only been involved in seed production for the past 3 to 4 years.

For both growers, the initial motivation to become involved in seed production came from their desire to improve the quality and consistency of seed available to WA growers. They both relocated their production operations away from major commercial production areas to give them the isolation and sufficient rotational land required for high quality seed production.

Initial development of the SQF 2000^{CM} Quality Code for certified seed production evolved through a process of extensive industry consultation over a period of eighteen months. However, when they committed themselves to implementing the Code, Tom Fox and Lindsay Radomiljac achieved their accreditation in less than four months.

Lindsay Radomiljac (left) and Tom Fox inspect *Delaware* seed potatoes

"For us, implementation of the SQF 2000^{CM} Quality Code was a logical progression after commencing seed production under the recently revamped WA Certified Seed Potato Scheme," Tom Fox said.

"We were required to critically examine all of our seed production practices, from the time we receive early generation seed onto the farm to when we load-out graded and packaged seed to our customers" he said.

"We now have a planned and documented approach to quality management at each step in our production process and

this has resulted in improvements to the organization and efficiency of our operation. Also, our staff have been given greater responsibility and training, and their level of job satisfaction has improved greatly".

Lindsay Radomiljac agrees. "Our QA system saves us time because our whole operation is better organised and we identify and correct any problems before they can affect seed quality," he said.

For seed buyers, the major advantage of purchasing seed from QA seed growers is the assurance that quality checks are built in to every step during the production, grading and storage process. This means seed buyers are assured of consistently receiving seed that meets the final product inspection standards required for certification, as well as any additional quality criteria agreed between seed grower and seed buyer.

In the event that a complaint is made about QA seed, resolution of the complaint remains a matter for negotiation between seed grower and seed buyer. However, QA seed can be traced back through the entire production process to identify the cause of any problem. The seed grower is then required to take the necessary corrective action to avoid the problem recurring.

"It is a good feeling to know that, at the end of the day, you have done all you can to ensure your customers receive only top quality seed," Lindsay Radomiljac said.

Western Australian seed growers who implement a recognised QA system are permitted to 'certify' their own produce. Agwest Seed Quality will continue to inspect crops in the field. For QA growers, Agwest will not be required to inspect tubers in every load.

However, Agwest will conduct random checks on an annual basis to ensure the growers are following the agreed grading and quality checks and their product continues to meet the standards set in the rules of the WA Certified Seed Potato Scheme.

"This means the auditing costs of maintaining our QA system are more than offset by the savings we make on tuber inspection fees." Lindsay Radomiljac said.

"Not only do we save on inspection fees, but being quality assured means we now have the confidence to expand our business to supply seed to markets overseas and to new customers in other Australian states" Tom Fox said.

Western Potatoes became the driving force in initiating SQF 2000^{CM} after recognising the future of the industry lay in the provision of improved, high quality potato products.

Implementing quality systems and procedures at every stage of the production chain, from seed production to washing, packing and transportation of ware potatoes, is seen to be the most effective way to improve the quality and safety of product offered to consumers. It will allow the industry to respond to changing consumer expectations and also be internationally competitive.

The implementation of SQF 2000^{CM} in the Western Australian potato industry is also timely in light of the new National Food Hygiene Standards proposed by the Australian and New Zealand Food Authority. An essential requirement of these Standards will be the adoption of Hazard Analysis Critical Control Point (HACCP) systems. In contrast to the alternative ISO 9000 Quality Assurance series, SQF 2000^{CM} uses HACCP as a framework to provide assurance of food safety as well as product quality attributes.

SQF 2000^{CM} is tailored to the horticultural industry, is easy to audit and requires less paper work, compared with other quality systems.

Western Potatoes continues to be committed to promoting the SQF 2000^{CM} Quality Code within the industry in order to provide WA consumers with consistent quality and confidence in WA potatoes. ■

Which way to QA?

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A project aimed at developing a quality assured production and marketing system for fresh potatoes is unravelling the great QA mystery and offering growers simple solutions to meet the QA requirements of today's markets.

Six day old paper bag display

The project has been developed to apply the principles of quality assurance to fresh potato production to improve the level of consistency of the national crop.

This was in response to a number of studies which showed that the potato industry needs to improve its understanding of and performance in areas such as quality, marketing, quality management systems and food safety.

This project is being undertaken by a pilot group of volunteer growers in the Lockyer Valley in south east Queensland. These growers have undertaken market trials supplying premium loose brushed *Sebago* in 20 kg bags to a major retailer and using the feedback from this real life marketing chain to develop a QA plan that satisfies the market requirements.

Outcomes from market trials

Advantange of having a product specification

Working to an agreed product specification meant that growers had a consistent target to meet, rather than a moving one. This meant that growers were able to continuously improve their harvesting and grading operations.

Consistency

Supplying produce to retail outlets involves more than just supplying **consistent quality** but also **consistent quantity**. Growers had to schedule their harvesting and grading to meet demand. Previously harvest has been something done as quickly as possible to beat poor weather and uncertain prices.

Records

By keeping quality control records, growers were able to rate and demonstrate potato quality after it had left the farm.

A combination of documentation and 'packed on' dates on bags (**traceability**) allowed growers to monitor the movement of produce beyond the farm gate and help the merchant and retailer pinpoint problems such as stock rotation.

It also allowed growers to assess individual lines of produce on display after making modifications to the harvesting and grading process.

Cool chain handling

Cool chain handling of potatoes in a hot climate improved quality and shelf life.

Bags

Paper bags appeared to be a better option than hessian bags for the following reasons.

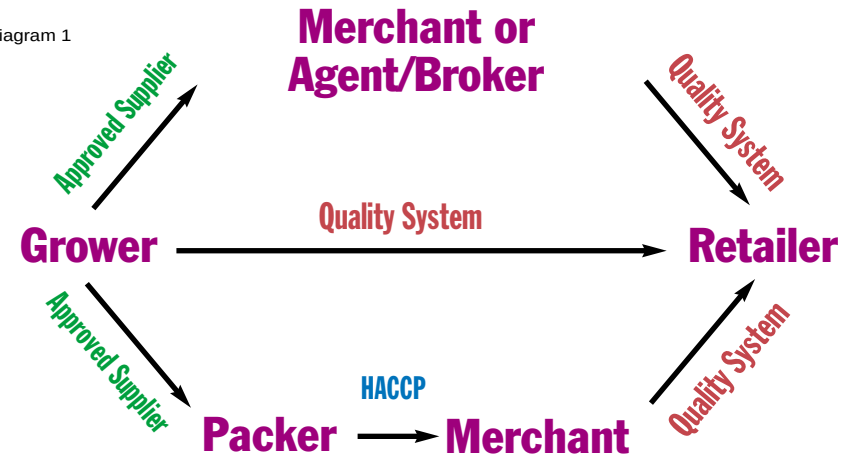
- there was less greening of tubers in paper bags than in hessian bags
- dehydration of the tubers occurred more slowly in paper bags than in hessian bags
- the improved quality of tubers in paper bags due to less greening and dehydration led to increased sales

However the use of paper bags required modifications to handling/packaging equipment and procedures.

Consumer decisions

Consumer decisions to purchase are not totally price driven with product quality and consistency being a major

Diagram 1



consideration in most areas. There is a definite preference for **sound**, **uniform** potatoes.

There was no apparent preference for potatoes from a particular soil type but the older the potatoes on display, the harder they were to sell.

Who needs a QA system?

The pilot group have also been finding out just what level of QA is needed in the retail market.

There are a number of supply chains, and depending who your market is, the level of QA required can be very different. Contrary to popular belief, not everyone needs a QA system. How far you go is dependent on who you are and where you want to supply in the future.

There are three distinct options (see Diagram 1).

1. Approved supplier to certified packing shed or merchant

This will require a number of measures to be documented some of which may already be in place. These may include the following.

- property map
- crop history (spray diary)
- calibration and records
- chemical user training
- correct storage of chemicals
- pest control
- packing record
- product specification
- completed food safety checklist

This documentation is done as an agreement between you and your customer. No third party accreditation is required.

2. Supply via a certified merchant

A merchant may have a quality management/food safety system and you will need to be an approved supplier to this system. (If you have a large packing/washing operation you may also need a HACCP plan in place for the shed to cover food safety.)

3. Direct Supply

If you directly supply someone like a retailer who requires a full quality management/food safety system such as HACCP, SQF2000, ISO9002, or WVQMS (Woolworths vendor quality management scheme) you will need to implement one of these systems and be certified by a third party organisation. Likewise if you intend to supply to a retailer in the future, you will need to meet your particular customer's supply requirements.

The diagram below shows some of the possible ways to supply the retail sector and what QA fits in where.

By gaining a certification for the packaging shed, a grower can make their own growing operation an approved supplier. This then gives them the flexibility to purchase off other growers (as long as they are approved suppliers). This means a number of growing operations can feed into the one certified shed. This is particularly relevant to smaller growing operations and marketing groups where the cost of a one off certification for everyone would not be economically viable (see Diagram 2).

Food safety and potato growing

The key aspect of all QA systems that is emerging as being relevant to the wider potato industry, is the adoption of a food safety system such as HACCP. HACCP is most relevant to the packaging and washing operations. Some customers who do not require a full QA system will most probably require a certified HACCP system to be in place for washing and packing.

The growing phase of production can be approved if the measures in the program outlined earlier are implemented. This type of pre-requisite program has not existed until now and should for the moment alleviate the need for a HACCP plan for growing the crop.

As part of this project a food safety checklist is now available for growers and covers some of the key food safety issues in potato production. At this time, this is as far as you need to go for food safety for growing potatoes. This checklist was printed in the June 1998 issue of Eyes on Potatoes.

Summary

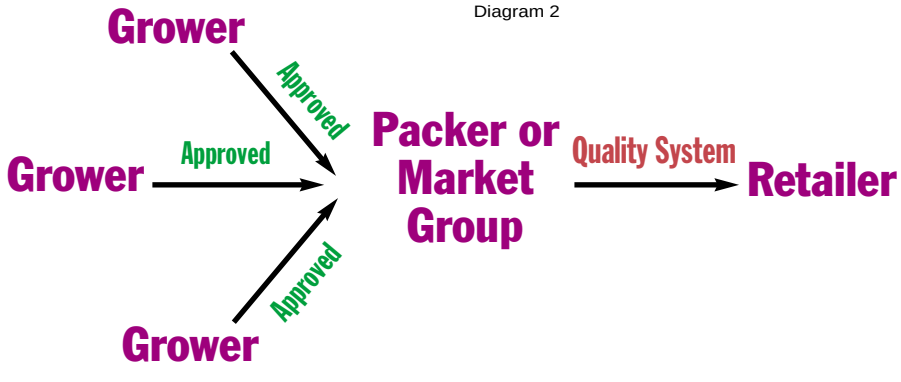
Find out what your market needs before rushing in to a full quality/food safety management system. Everyone will need to be at least approved suppliers so this is the best place to start.

Becoming an approved supplier is inexpensive and the elements of it are relevant to farming issues other than just food safety. By implementing these measures yourself, you will be doing something a lot more meaningful than hiring someone to implement a full quality/food safety management system and having a manual you don't understand.

Acknowledgments
This project has been funded by HRDC.

HRDC ■

Diagram 2



Potatoes and the Food Services Market

To assist in the development of the Potato Industry Strategic Plans the APIC R&D Committee commissioned Richard Strategic Services for a study of the Food Services market. A small study was carried out to identify (from the Food Service operators' perspective) any particular issues, problems or opportunities that might be addressed through the R&D program and to provide a guide to structuring a more comprehensive study.

The Food Service industry consists of anyone (excluding 'domestic') who purchases and prepares food for others to eat. This includes groups such as restaurants, caterers, hotels, fast food operators, hospitals, airlines, jails and the armed services. The industry is huge.

The study involved structured telephone interviews of twenty six people from the following types of organisations : National Airline (1), Hospitals (3), Fast Food Operators (5), Jail (1), Armed Services (2), Restaurants/Hotels (8) and Commercial Caterers (6).

Questions were asked to gather information about :

- What types, where, how and how often the interviewees buy potatoes?
- What influences their purchase decisions?
- What problems they experience in relation to potatoes?
- Any other comments or suggestions?

	The terminology used
Term	**Definition**
"**Fresh**"	Any kind of fresh potato (maybe washed)
"**Processed**"	Potatoes that are processed or part processed in some way, but not frozen (including 'Deb' type, peeled, sliced, diced, etc..)
"**Frozen**"	Any type of frozen potato product including fries (chips), wedges, hash browns, etc..

The Food Services industries represent a very large market for Australian potatoes.

What type of potatoes are purchased

The type of potato purchased was very dependent upon the type and size of the Food Service operation and the usage/cooking occasion as shown in the table.

	Fresh	Processed	Frozen
Airline (1)	15% (for mashing)	15% (Various styles)	70%
Large Caterer (1)			80% (Fries)
Small Caterer (1)	100%		
Large Hospital (1)		100% (Processed or Frozen)	
Smaller Hospital (1)	100%		
Institution (The Jail)	100%		
Restaurants (2)	100%		
Restaurants (4)	65-90%		10-35% (Fries/Wedges)
Restaurant (1)	20%	70%	10% (Fries)
Restaurant (1)	75%	25%	

Fresh potatoes

All interviewees were able to clearly nominate the fresh varieties they purchase, however there were no particular varieties that dominated.

Many varieties were named and it was clear they were being chosen for purchase according to their intended use. This suggests the interviewees had a reasonable understanding of the different varieties and their qualities.

Processed and frozen

When talking about processed or frozen purchases, varieties were not mentioned at all. Interviewees were however very aware of the type/style of processed or frozen potatoes purchased (ie sliced, diced, fries, wedges, hash browns, etc.) and the features of each.

The vast majority of processed or frozen potatoes purchased seems to be as chips/fries. Again, it appears purchase in the processed and frozen group is very much guided by usage intention, menus, etc.

Fresh potatoes

Where, how and how often do they normally buy?

Almost all interviewees purchased from someone they described as a "merchant" or a "wholesaler". These suppliers are trusted and provide product regularly. Quite a few said that they have two or three suppliers to ensure they get the quality and the varieties desired, and to encourage competitiveness.

Mostly the interviewees were purchasing fresh potatoes two or three times a week, though some of the restaurants and hotels said that they purchase daily.

What influences the purchase decision

All but one interviewee (from one of the Institutions) said that quality is the **absolutely dominant influence on their purchase decision**. They say they just cannot afford to purchase food that is not good quality. Our impression is that they are quite prepared to change suppliers if the quality does not meet the standard they expect.

After quality, the influencing factors are price and intended usage. These appear to be linked, in that some interviewees indicated they may be prepared to pay a higher price for potatoes which suit a particular cooking/preparation style.

Overall, the restaurants in this study appeared to be more menu-driven. That is, the chef decides on the menu and that, to a large extent, dictates the potato purchase.

Problems in purchasing

Very few problems are experienced in purchasing fresh potatoes. This relates directly to the relationship between the Food Service operator and their supplier. Some said that their supplier will readily replace produce that is a problem. Where problems were mentioned the issues involved were:

- bruised, damaged or rotting
- not storing well or as long as expected
- black inside when cut.

Problems with cooking

There were also very few problems with cooking. Any problems appeared to be particular isolated instances, rather than overall. Four of the 26 interviewees did mention having problems with mashing potatoes - the final product being lumpy or not keeping well.

Processed and frozen

Where, how and how often do they normally buy?

The organisations covered in this study have usually only one nominated or contracted supplier. Purchase frequency ranges from daily to weekly depending upon products purchased and volume.

What influences the purchase decision?

The dominant influence mentioned is **price**. Then comes **service** and **range** of **products**.

Interestingly, the quality of products was not spontaneously mentioned. We wonder if this is because, in the processed and frozen categories, quality is a given. That is, purchasers naturally expect to be supplied with consistent, quality products so that criteria does not come into the decision process.

Problems with purchasing & cooking

Overall, no problems were raised by these interviewees in relation to purchasing or preparation of processed or frozen products.

Suggestions

Interviewees were invited to make suggestions in any area in relation to potatoes that may increase usage, improve supply or make their job easier etc. Their suggestions follow. The number and type of Food Service operation making the suggestion is in brackets.

Packaging

Bags allow potatoes to be bruised in handling and are not easy to store. Would prefer potatoes supplied in boxes (1-Airline).

A smaller bag (say 10 kg) of baby potatoes for smaller caterers and restaurants would be preferred (1-Caterer).

Smaller bags are needed as 50 kg bags are too heavy and not possible for one man to handle easily (1-Institution).

Product information

A significant number of interviewees said they would like to have more information about potatoes. Specifically they mentioned:

- information on varieties, their qualities and uses
- details about regions, seasonality and their influence on quality and cooking
- new ideas for preparation and cooking.

Food service operators are used to being provided with this type of information and stimulus material by their suppliers. Meat and dairy are good examples of industries with programs in this area.

New products

Two interviewees said they would like to see more new and innovative frozen and processed products introduced to stimulate increased use/consumption.

Conclusion

There can be no doubt that the Food Service sector will play an increasingly important role in total food consumption in Australia. The trends toward purchasing pre or part prepared meals and out-of-home eating, are well established and will continue. Potatoes' territory of the in-home and more traditional meal is being eroded.

Potatoes, both fresh and processed, must secure their place in the eating patterns and styles of the future. To do so, the industry must have pro-active strategies that will establish and maintain a strong position in the Food Service markets.

Food Service market research

Sound market research, upon which strategies can be based and performance measured, is essential. A formal and comprehensive study of the Food Service market is needed. It should encompass:

- quantification of market segments, their size and trends
- usage and attitudes information
- identification and some quantification of market, product and marketing opportunities.

Improved packaging

This study has identified two areas where packaging may be improved. The market research (mentioned in the above section) may reveal others. Each should be considered, evaluated and if appropriate, incorporated into the industry's planning processes (R & D and Marketing).

More product information

The Food Service market is 'information hungry'. They want to ensure they are using the right product (or variety) in the right way. And they are keen to be stimulated with ideas, usage suggestions, etc.

Based on a foundation of sound market research on the Food Service market this area of product information could form an integral part of the industry's overall marketing campaign.

Acknowledgements

This report was commissioned with funds from HRDC.

HRDC

Retail quality update

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Surveys in Sydney and Melbourne show continued problems with fresh potato quality.

In January 1998, the Australian Consumers' Association commissioned Agriculture Victoria to conduct a "snapshot" survey of fresh potato quality in retail outlets. This formed the basis of an article in the ACA's *Choice* magazine (June 1998), and followed continued complaints about quality from subscribers. It also served as a useful update on a similar study made in 1995.

The survey was conducted on samples of prepacked bags of brushed potatoes and compared Coles, Safeway/ Woolworths, Franklins and greengrocer retailers in both Melbourne and Sydney. A total of 120 purchased samples were assessed for skin blemishes, greening, mechanical damage and boiling quality (after-cooking darkening and disintegration). The net weight and number of tubers in each sample were also recorded.

Results

Weight and number

Even before individual tubers were assessed, a major quality problem became apparent - **almost half** of the samples (47.5%) were **underweight**, with almost half of these being underweight by more than **50g**. Losses of soil and moisture after packing could account for a small amount of weight loss. However, regardless of the cause, none of the packs specify an "at packing" weight and so consumers should expect to receive a minimum of the stated weight of product.

All of the Melbourne samples were in 5kg packs, but most of the Sydney samples were supplied as 4kg packs. The average number of tubers in 5kg packs was 29 (ie. 172g per tuber), while the average number in 4kg packs was 23 (178g per tuber). The smallest tuber assessed weighed 50g and the largest more than 450g.

Greening

Since slightly green potatoes can soon become severely green, any degree of greening is an important defect. In this study, **20%** of tubers (by number) showed **greening**, and **78%** of samples contained green potatoes.

Often, greening only became apparent after tubers were washed for assessment. This challenges the idea that brushed potatoes are not susceptible to greening - it seems that they simply hide greening better than washed potatoes do. Brushed and washed potatoes need equal protection from light along the handling chain.

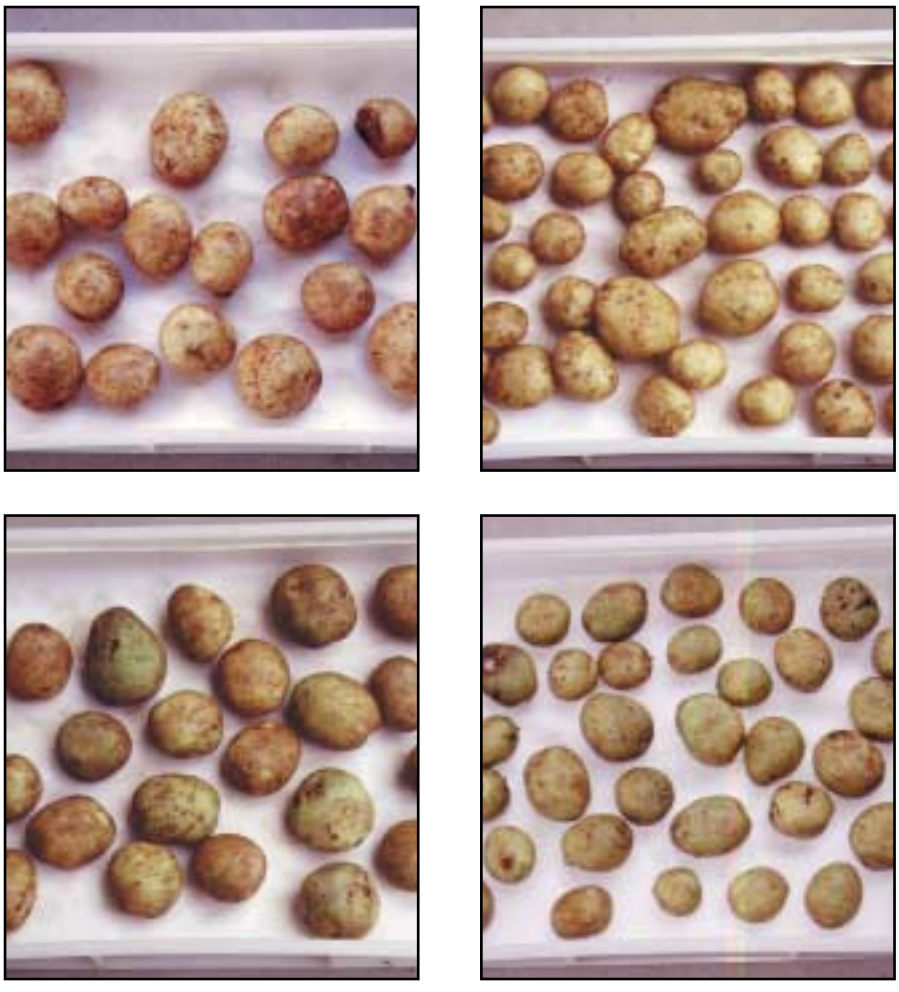
Mechanical damage

Mechanical damage was the most common **severe** defect found in the survey, with **25% of tubers** (by number) affected and **98% of samples** containing severely damaged tubers. In fact, this is probably an underestimate, since blackspot bruising (which may not affect the skin) was often apparent once tubers were peeled for boiling.

Mechanical damage tended to be severe rather than slight, suggesting that the potential for damage along the handling chain continues to be underestimated.

Skin blemishes

Apart from the effects of pests and diseases, skin blemishes in this study



Examples of the ranges in tuber size, number and quality found amongst survey samples (5kg)

included physiological defects such as skin cracking and russeting. Although a few samples were badly affected by diseases such as powdery scab, on average only 6% of tubers per sample showed blemishing likely to deter consumers from buying brushed potatoes. On this basis, skin blemish is less of a threat to potato sales than are greening and mechanical damage.

Boiling quality

After-cooking darkening and disintegration were assessed with a 5 point scoring system used in variety evaluation, where score 1 = nil defect and score 2 = slight defect (etc.).

After-cooking darkening was found not to be a serious defect in this survey; 33% of samples showed evidence of darkening (mostly in the "score 2" category), and the overall average score was 1.16.

Disintegration was evident in 81% of samples and had an average score of 1.52. It was considered to be a significant defect on the basis of this survey.

Although boiling performance is influenced by potato variety, these tests did not take variety into account. In effect, this parallels the situation met by the consumer, unless variety and end-use are specified on the pack. If consumers are not informed otherwise, they will reasonably expect potatoes to boil successfully.

Of the 120 survey samples, only 47 were labelled with the variety - all of these were *Sebago*, which generally boils well. If poor-boiling varieties are presented "anonymously" to consumers, then the result is likely to deter repeat purchases.

Other observations

Many of the sample tubers had thick clumps of soil adhering to them. These were difficult to wash off and could not be easily removed by peeling, which reinforces the perception that brushed potatoes are inconvenient to prepare for cooking.

Many samples contained tubers which had sprouted, with some sprouts up to 2cm in length. In a few samples, most of the tubers were soft, indicating moisture loss. Both of these disorders reflect poor storage and handling procedures.

Comparisons between retailers and between cities

Among the many comparisons made between retailers and cities for each of the quality defects, only the following were found to be statistically significant:

- Melbourne samples contained more potatoes with mechanical damage than did Sydney samples
- Franklins and greengrocer samples contained more potatoes with greening than did Coles samples
- Coles and Safeway/Woolworths samples gave a higher average disintegration score than did Franklins and greengrocer samples
- Both Coles and Franklins samples from Melbourne contained more potatoes with severe skin blemish than did their counterparts in Sydney
- In Melbourne, Coles and Franklins samples contained more potatoes with severe skin blemish than did greengrocer and Safeway/Woolworths samples

Without a detailed analysis of the supply chains of each retailer in each city, the reasons for the above results cannot be pinpointed. Nonetheless, the results are too inconsistent to make general conclusions about the retailers and cities as suppliers of brushed potatoes.

Comparisons with 1995

The following table compares results from the 1998 survey with those from a 1995 study by Agriculture Victoria (where direct comparisons could be made):

Both of these surveys were "snapshots" and do not represent an average quality over a period of time. In addition, no statistical comparisons have been made between the two years and so conclusions must be made with caution. Hopefully, the decrease in mechanical damage is a result of improved handling and storage practices; this could also contribute to the improved boiling quality. However, if handling practices have improved, they have not addressed greening, which remains a serious problem. Supplying a product of consistent quality year-round requires a total quality management approach throughout the supply chain.

What next?

As a part of its CQ-Potato project, Agriculture Victoria is undertaking a number of activities aimed at improving fresh potato quality. These include:

- auditing of the critical cost and quality points from the farm to the supermarket shelf
- development and facilitation of total quality management practices for the supply chain
- development of a photographic descriptor language for potatoes

These activities should assist the industry to overcome the quality problems which are still clearly in evidence.

Acknowledgements

The 1998 survey was funded by the Australian Consumers' Association. Survey data and the *Choice* cover are reproduced here with the ACA's permission. ■

Quality defect	Year		
	1995 (Melb)	1998 (Melb)	1998 (Melb+Sydney)
Greening (% by weight)	21	24	21
Mechanical damage (severe) (% by wt)	50	29	28
After-cooking darkening (average score)	2.07	1.15	1.16
(% of samples)	94	23	33
Disintegration (average score)	2.17	1.47	1.52
(% of samples)	100	80	81

Notes:
* The 1995 survey was made on a percentage by weight basis only
* The 1995 survey was made in June and the 1998 survey in January
* The 1995 figures shown are for the brushed potato component of the survey
* Skin blemish data were not compared, since different assessment criteria were used

Can your soil become a fertiliser?

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Stuart Little talking to growers about the trial

An innovative project looking at how cover crops can trap phosphorus which is locked up in the soil and release it for the benefit of the following crop.

The sustainable potato production in highland NSW project is now in its third stage. Since beginning in 1993 the project has now expanded to include the Robertson, Dorrigo and Guyra potato growers.

The issues being dealt with include integrated pest and disease management, irrigation management and crop nutrition. The newest area of investigation is soil phosphorus management.

In stage I and II of the project, soil testing showed high to very high levels of soil phosphorus. Plant testing indicated that the plant was not able to use most of this soil phosphorus. This was supported through fertiliser trials showing significant crop responses to phosphorus fertiliser application.

Growers felt there must be a way to access this soil phosphorus and approached the Australian National University (ANU) for assistance. Subsequent discussions have led to the implementation of this phosphorus management project.

Cover crops to release phosphorus

The principle aim of this work is to investigate the use of cover crops consisting of white lupins and a brassica as a mechanism for releasing phosphorus absorbed by soil particles and making it more available to the subsequent potato crop. White lupins secrete organic acids from their root systems that dissolve fixed phosphorus making it available to the plant.

The work is being run during 1998 in conjunction with ANU and CSIRO. The research is being conducted by Stuart Little as his honours project, under the supervision of Dr Richard Greene (ANU) and Dr Peter Hocking (CSIRO) and in cooperation with Robertson growers Trevor, Barry and Allan Donovan.

The project consists of a field trial, located on the Donovan property at Robertson, and a pot trial in the ANU glasshouses at Canberra. Each trial consists of 5 treatments, replicated 4 times. The treatments are as follows: (i) bare soil (control), (ii) local practice (oats only), (iii) brassica only, (iv) white lupins only, and (v) white lupins and brassica combination.

The pot trial is an exact replica of the field trial (using soil sampled from the same paddock) with the exception that the growth of both the cover crop and the subsequent potato crop can be accelerated using optimum conditions of the glasshouse.

Biofumigation, phosphorus release and grazing potential

The combination of a brassica and white lupin is the ideal cover crop providing biofumigation, and phosphorus release as well as grazing potential.

It is anticipated that the brassica will benefit from the phosphorus release by the white lupin due to its large mass of fine roots infiltrating the root zone of the lupin and making use of the released phosphorus. With the large above and below ground bulk of the brassica plants combined with the bulk of the lupin plants, a large store of organic phosphorus is created. When the cover crop is incorporated, this phosphorus will be released into the soil and made available to the following potato crop.

Major off site benefits

The cover crop option of a brassica-white lupin combination will still provide the benefits of traditional cover crops, (ie grazing, soil conservation and structural improvements) but has the potential to boost yields and profits per hectare by reducing fertiliser inputs and reducing losses to ground dwelling pests.

The major off-site benefit is the reduction of phosphorus inputs into water catchments by reducing fertiliser applications and reducing the fixed phosphorus pool within the soil, therefore reducing the concentrations of phosphorus added to watercourses by erosion and runoff from potato growing areas.

The outcomes of this work will be published in the 1999 edition of *Potato Australia.*

Acknowledgments

The project is funded by HRDC, APIC, RDPA&LA, DDPG&LG, Guyra Potato Growers, Wingecarribee Shire Council and Sydney Water. Technical support has been received from Robert Spooner-Hart, UWS-Hawkesbury, Len Tesoriero, NSW Agriculture and Mike Robbins, NSW Agriculture. HRDC

Dr Peter Hocking (CSIRO Plant Industries) showing growers the root system of the white lupin

Review of IPM in potatoes in Australia

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IPM stands for integrated pest management and involves using a range of methods to control pests in crops.

IPM helps growers to reduce the need to rely solely on insecticides to control pests. It integrates several ways of controlling pests to achieve management of pest populations. This is a change from the approach of attempting to eradicate all pests from a crop.

Not all insects are pests

Many different species of insects live or move through potato crops. By no means are all of these pests. Most are beneficial (predators and parasites that eat pests) or benign, and not of concern or particular help in pest control. Different production districts also have very different pest concerns, and what is a major pest in one area is likely to be of no concern in another.

Common predators and parasites of potato pests
(These beneficial insects and spiders can easily be killed by broad spectrum chemicals.)

Pest	Predators
Potato moth	Wasps Damsel bugs
Aphids	Wasps Hover flies Lacewings Ladybirds
Heliothis	Wasps Tachinids
Spodoptera	Wasps Smudge bugs Shield bugs Lacewings
Loopers	Wasps Damsel bugs Spiders
Leafhoppers	Damsel bugs Lacewings
Green vegetable bugs	Parasites
Thrips	Predatory bugs

Some of the more important pests of potatoes are aphids, potato moth, heliothis, *Spodoptera*, looper caterpillars, wingless grasshoppers, crickets, leafhoppers, mirid bugs, Rutherglen bugs, thrips, whitefringed weevils and black beetle.

To counter these pests, there are a range of insects that will attack them. These include wasps, damsel bugs, lacewings, ladybird beetles, parasitic flies and shield bugs. All of these occur naturally in Australian potato growing areas and can be found in crops where insecticides have not been used.

Some species such as green lacewings, *Trichogramma* wasps and *Orgilus* wasps can be bought from commercial producers and released into the crop. They will only control specific pests and need to be released at a particular time (usually indicated by monitoring).

Where does IPM fit into the picture

In potato crops, IPM uses biological controls (predators and parasites) and cultural controls (eg. irrigation, weed control) backed up where necessary by strategic use of chemical insecticides.

IPM is a means of dealing with all pests simultaneously, not just one or two such as potato moth or heliothis.

To use an IPM strategy, information is required on all pests, and as many of the beneficial species as possible.

It has taken about 10 years to develop the understanding needed to produce a workable IPM strategy that can be applied in most potato growing areas of Australia. IPM began with work on potato moth in Victoria, but is now capable of providing a method of managing all pests in most cases.

Why use IPM

IPM strategies have been developed in many crops to deal with problems such as insecticide resistance, health and safety issues, chemicals being withdrawn from use and pests not killed by insecticides that build up in numbers when predators are controlled by chemicals.

In Australia research on IPM in potatoes commenced when the organochlorine insecticides (ie. DDT, dieldrin and heptochlor) were withdrawn in 1987. Until that time, organochlorine insecticides were permitted for certain uses, including control of several pests of potatoes (potato moth, potato wireworm, whitefringed weevil, African black beetle).

What is involved in using IPM

There is no doubt that IPM is more complex than relying totally on chemical insecticides.

When using IPM, a potato grower needs to know exactly what is going on (in terms of insects) in each paddock at any given time. To obtain such information, the crops must be monitored regularly (weekly) and not only for pests. Knowing how many beneficial insects are present in each crop is just as important as knowing how many pests are there.

Research in Australian crops has demonstrated that they contain a huge array of beneficial insects including parasites (usually wasps and flies) and many different predatory species (such as lacewings, ladybird beetles, damsel bugs and red and blue beetles). The predators are all native Australian species

that occur naturally. A survey of introduced parasitoid wasps that attack potato moth showed that two or three species were present in all districts.

A recent development has been the release of high numbers of a wasp (*Orgilus lepidus*) that attacks potato moth. This involves releasing insectary reared wasps into crops, before there is any sign of potato moth, so they can suppress the build-up of the moth.

How well crops tolerate pests will vary depending on many factors including pest numbers and presence or absence of preditors and parasites. This tends to make the decision as to whether to spray or not more difficult as the number of pests needed to justify spraying could differ quite a lot between districts.

Growers reaction to IPM in Australia

Growers in Australia are now much more aware of IPM than they were just a few years ago. Adoption of IPM has been very high where there has been someone to provide information, first-hand, on IPM. In a national survey of growers, we found 100% adoption in districts or grower groups where a local advisor was providing information on IPM.

IPM can be used by growers in any sector - seed, crisping, processing, ware or organic.

The changing role of insecticides

Changing to IPM means that growers will not only use less insecticide in most cases, but will also change from using broad-spectrum insecticides that kill most insects, to selecting insecticides that will kill the target pest with minimal effect on beneficial insect populations.

Some targetted chemicals exist and are registered on potatoes (eg. Pirimor). Other chemicals are in the process of being registered or being developed.

Besides chemicals there are also sprayable formulations of bacteria, fungi and viruses which have been developed to control particular pests. These have yet to be approved for use on potato crops.

How do we compare to overseas

The IPM strategy for controlling potato pests has resulted in most growers who use it significantly reducing their insecticide use without compromising yield or quality (see article by Peter O'Sullivan in *Eyes on Potatoes*, Dec 1997). Many IPM growers regularly produce crops without a single application of insecticide, where a few years ago they could have sprayed the same crop 5-7 times. This achievement is significant and puts Australian growers ahead of the rest of the world.

Benefits from IPM research

In the simplest terms, there are approximately 2,500 potato growers in Australia. If only 25% of these growers save a single insecticide spray at a nominal value of $400 per crop then nationally $250,000 would be saved, each year, by growers. This is much more than was spent on research in any one year, and the savings will continue long after the research has stopped.

In our experience, individual growers adopting IPM have saved vastly more than $400 per crop. Savings per grower have been estimated (by growers) at closer to $10,000 per season per farm.

In addition to the savings per grower, the research has provided the industry with a sustainable approach to pest control. Problems of insecticide resistance and of residues in Australian potatoes have been significantly reduced.

The future

IPM relies on monitoring pest and beneficial insects. To monitor you must be able to identify the insects you find. This has been a particular problem for Australian growers as there has been no easy to use guide that includes most of the insects. A new project supported by HRDC aims to address this problem and produce a manual and field guide (see article in New projects approved by HRDC).

There are pathogens being developed in Australia and overseas to control particular pests. These include fungal pathogens (to control aphids, thrips, grasshoppers), bacteria (to control caterpillars) and viruses (to control heliothis and potato moth).

Commercial formulations of all these pathogens exist but are not yet registered on potatoes in Australia. Similarly, chemicals which are more selective and do not have such detrimental effects on beneficials (eg. Pirimor) are either available but not widely used, or being developed and registration on potatoes yet to be sought. ■

Growers at a field day in the South Australian Mallee searching for insects in a crop

Enough to make you 'owl

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Members of the Lapdogs (the Lucky Atherton Potato Diggers Option Group) in far North Queensland have extended their interest in integrated pest management to rat and mouse control.

In the dry season when potato crops are being irrigated, rodents can become a major pest of potato crops by feeding on the tubers and uncovering others.

Owls on the Tablelands are well known predators of rodents. One pair of breeding owls have been shown to capture ten rats per night. However, large areas of potatoes do not have many places in which owls can perch to observe prey activity and not too many nesting sites exist around the majority of farms.

Sugar cane farmers on the adjacent wet tropical coast have had good success with rodent control by increasing both the number of perches and nesting sites, often using artificial articles. Unfortunately field use of rat baits is a common practice in the expanding sugar cane industry on the Tablelands and secondary kills of rodent predators seem to have reduced owl numbers.

One potato group member has recently installed an artificial nesting box to try to increase owl numbers on his farm. Others are watching his attempt with interest. On going to print, no owls had taken up this rent free residence but we are hoping that this will not be a long wait. Maybe 'wise' readers of this article will cause a late rush!

The possibility of managing rodent numbers by using a biological agent and not relying on dangerous chemicals as well as saving money, appeals to these growers as a logical extension of their good work in insect control with reduced broad spectrum insecticide applications. ■

Richard Standen with the owl box he hopes will prove an attractive nesting site.

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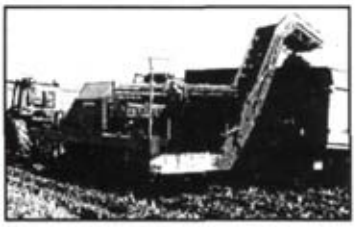

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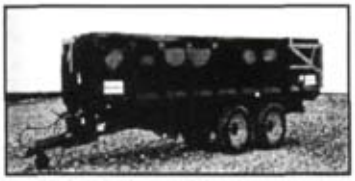

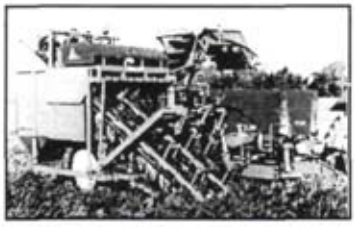

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CQ-Potato - how's it going

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(Compiled with the CQ-Potato team)

The CQ (Competitive Quality)-Potato project has the aim of increasing the factory gate value of the Victorian potato industry to $525 million and potato exports to $20 million per annum by 2001.

The project was launched in June 1997 and although the focus is on exports, there will be a number of "spinoff" benefits to the domestic industry along the way, as improved production and handling methods are developed.

The project is managed by Agriculture Victoria (Department of Natural Resources and Environment) and is overseen by a steering committee of industry representatives.

The following is a summary of progress to date.

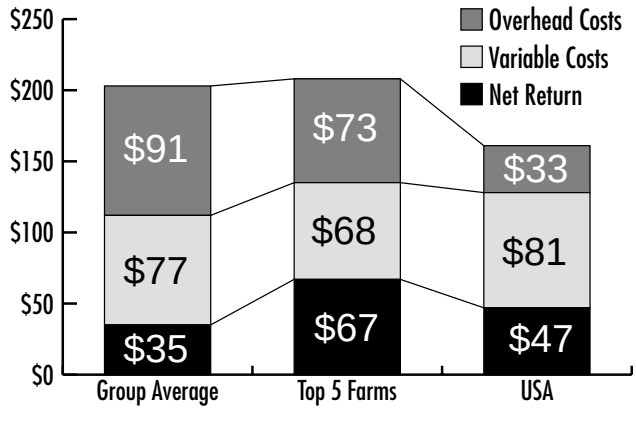
Benchmarking

In recent months, a number of Victorian French fry and seed potato growers have participated in the second round of potato benchmark studies. This follows on from the successful 1996-7 studies which identified a number of key issues limiting the profitability of both French fry and seed potato growing. The results of these studies were presented to growers in a series of meetings early in 1998.

French fry growers

The 1996-7 study revealed that the most profitable growers produced more potatoes for sale by obtaining higher yields (48 t/ha) **with a lower proportion of reject tubers and rejecting less waste** (2.4 t/ha). They also spent less on the variable costs of chemicals & sprays, fertiliser, fuel & oil and casual labour (Graph 1). Overhead costs were also reduced by these producers through lower investment in plant and machinery, thereby reducing repairs, maintenance and depreciation costs.

Graph 1. Comparison of Costs and net return for French Fry Potato growers in Victoria and the USA.



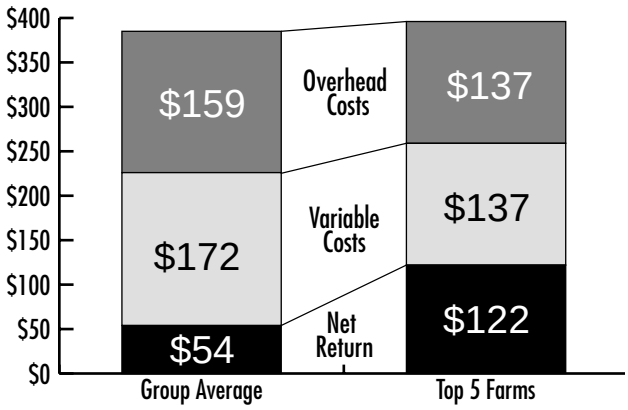
A further comparison of Victorian French fry growers with those in Washington State and Idaho, indicated that USA growers were more profitable than the average Victorian grower, despite receiving $40 less per tonne. This was mainly due to lower overhead costs, achieved through large areas of production, higher yields and low investment in potato plant and equipment.

This comparison also indicated that the top Victorian growers can compete with US growers on variable costs but still need to reduce overhead costs.

Seed growers

The top performing seed growers in 1996-7 were producing substantially higher yields (39 t/ha) than the average seed grower (31 t/ha). This higher yield was grown with little increase in cost and therefore the cost of producing each tonne was lower. In addition, the average price per tonne sold was also higher for these growers, due to a higher proportion of their crop being sold as mother seed.

The combination of higher yield, lower cost and higher average price per tonne for these growers resulted in a net return $68/t higher than the average grower (Graph 2).



Graph 2. Comparison of costs and net return for Victorian seed growers 1996-7

Market access

Photographic descriptor language

Draft photographic descriptors of potato quality depicting a wide range of potato disorders are now being submitted to appropriate industry people for comment. With the aid of photographs the descriptors provide a guide to describing different levels of disease on tubers. Traders can better negotiate over what levels are acceptable. The purpose of the descriptors is not to set standards, but to enable traders to speak the same language when negotiating.

The need for a potato descriptor language was recognised at a national fresh potato best practice workshop held in June 1997. It is supported by the Australian Horticultural Corporation and hopefully will be used on a nationwide domestic basis as well as in export.

After-sales service

Two jointly-funded programs were undertaken to assist potato growers in Indonesia and the Philippines to get the most out of their Australian seed potatoes. These involved visits to the potato-growing areas for practical demonstrations and the preparation of written guidelines for the growing and handling of the seed.

Exporters see this type of activity as vital in forging strong trade links, a view reflected by the increased orders received since the programs were run.

Export guidelines

Draft guidelines, presenting recommended handling procedures, document and inspection procedures and the options for exporting potatoes, were distributed for comment to more than 50 people around Australia. The guidelines are now being revised, taking account of comments received.

Market intelligence

Study tour to Indonesia

A 1997 study of potential export markets in Indonesia showed that the market for fresh crisping potatoes for processing in Indonesia was looking very good, and the market for seed potatoes was also buoyant.

Since then, the Indonesian monetary crisis has had dramatic impacts on the country. However, Mr Phillip Morey, the Victorian Government's Overseas Office representative in Jakarta, reports that Indonesian potato processors are still keen to source Australian seed potato varieties more suitable for Indonesian growing conditions. Trials with popular Australian varieties have shown them to be unsatisfactory for Indonesia, according to industry sources.

The Indonesians apparently believe that the local potato industry will remain in the doldrums in the short term, but will improve substantially in the mid to long term.

Asian market evaluation by the Australian Chamber of Manufacturers

The Australian Chamber of Manufacturers was commissioned by CQ-Potato to make a study of potato export markets in Asia. Significant opportunities exist for the markets in fresh, fresh for processing, seed, germplasm and processed potatoes from Australia.

The development of these markets needs to take into account the importing country's needs and interests to facilitate the development of long-term, successful relationships.

A key issue underpinning export development is competitiveness. Exporters need to be aware of how competitive they are relative to overseas competition in target markets.

Competitiveness should not only be examined from a cost/price perspective, but also in relation to service delivery and quality. Increased efficiency of the supply management chain will underpin competitiveness and encourage large scale production projects and joint ventures.

Positive achievement in these areas will offer improved market access and security, if managed in a balanced way to ensure that the best long-term interests of the industry are served.

Total quality management

Evaluation of drip irrigation for potatoes

Drip irrigation on potatoes in Ballarat was explored for a second season in 1997-8 and again showed good potential. The trial crop yielded well (about 56t/ha), in addition to several benefits that come with using such a system.

These include reduced water usage (in the order of 15% compared to a surrounding crop), reduced power needs (by at least 40% and possibly as great as 80% depending on the irrigator used), reduced labour for shifting irrigators and more even and timely water application.

The instrumented sphere at work

René de Jong explains the drip irrigation system at a field day

An extra 3t/ha of potatoes are required to cover the extra cost of this system ($850/ha), but this does not include savings in water and power. The savings in labour to shift an irrigator may be offset by some extra labour needed to lay and pick up the drip system (although this is still expected to favour drip irrigation). If the same drip tape is used for a total of three seasons, the cost is very competitive.

Improved seed production

Survey of blemishing diseases on G1 generation seed

A survey of G1 tubers in storage showed that planting in "new" ground does not guarantee disease-free progeny. Potential sources of disease in G1 include dust and airborne spores which can contaminate minitubers or G1 in sheds and stores during pre-planting or post-harvest handling and storage. There is an urgent need to develop hygiene and disinfestation strategies for potato farms.

Seedgrower discussion groups

CQ-Potato, together with the Victorian Certified Seed Potato Growers' Committee, invited growers in all seed-producing areas of Victoria to be involved in district groups for discussion of relevant issues and the exchange of ideas. For a fee, the growers are provided with guest speakers and activities at regular meetings. Groups have now been formed in the Thorpdale, Otway, Portland and Ballarat districts.

Round seed production

Many overseas markets will only accept whole (round) seed potatoes. In the 1997-8 season, two trials were conducted to find ways of increasing tuber numbers in Atlantic seed crops. The treatments used were:

- planting in beds vs. planting in rows
- using physiologically old and young seed
- chitting seed (exposing to light before planting)
- slashing the tops of newly-emerged plants to affect their hormone balance.

At the time of writing the results had not been fully analysed and they will be reported at a later date.

Mechanical damage in seed production

Demonstrations of the instrumented sphere, an electronic device which measures impacts (bumps and falls), have been made to identify the main problem areas for mechanical damage on seed grading lines.

The demonstrations have been run with seedgrower discussion groups and resulted in useful exchanges of ideas. In many cases, the risk of mechanical damage can be reduced quite cheaply, so the use of the sphere can lead to improved quality and savings.

Acknowledgements

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Integrated management of target spot

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A management strategy based on crop monitoring can successfully control target spot (early blight) and reduce spray applications by up to 63%.

New strategies for the management of target spot have been proposed as a result of four years of collaborative work between Tasmania and South Australia.

The project has shown that disease monitoring is a useful tool to predict the initiation and timing of fungicide applications for the control of target spot. Monitoring can be done either by walking through the crop or using electronic weather data loggers placed in the crop.

A spray program initiated after the appearance of the first target spot lesion was found to be the most consistent method of achieving effective control whilst minimising spray applications.

For this to work, regular and careful monitoring of the crop from tuber initiation is needed. If leaf infections are not detected very early, there is a risk of poor disease control and significant yield reductions. This is especially so when infection occurs early in the growth stage of the crop.

From the data obtained in this study and work done elsewhere, the following two strategies have been proposed for target spot control.

Strategy 1. Paddocks with low disease risk

These are paddocks with:

- a history of well controlled volunteer potatoes and alternative hosts,
- not adjacent to a likely disease source such as the previous year's potato paddock or cull piles,
- not downwind of a likely disease source, and
- more than three years since the last potato crop.

Note concentric rings of target spot

Low Disease Risk Strategy

1. Crop Monitoring
(Commence no later than row closure.)

Do not irrigate between mid afternoon and dawn as this will increase the chance of creating infection periods.

If threshold of 5 lesions per 10m bed is not reached before 4 weeks from senescence, spraying should not be necessary.

2. Field Inspections
(Walk through the crop at least once per week inspecting lower leaves for lesions.)

3. First Lesion Found
(Mark area with a pole and continue crop inspections checking for distribution in entire crop).

2. Electronic Monitoring
(Electronic data loggers with sensors within the crop canopy can identify an infection period.)

3. Infection Period Recorded
(Commence crop inspections to check for presence of lesions and increase diligence of inspections as more infection periods are forecast).

4. Infections Increasing
(Sprays will need to commence once disease increases, and before reaching the threshold level of 5 lesions per 10m row.)

If disease is confined to a small patch, consider spot spraying.

5. Spray Schedule
Apply Score and repeat 10-14 days as per manufacturers recommendations, and then commence protectant program 10-14 days after the last Score application.

High Disease Risk Strategy

1. Crop Monitoring

(Commence 2 weeks after emergence.)

Do not irrigate between mid afternoon and dawn as this will increase the chance of creating infection periods.

If irrigation creates an infection period, Score is best applied after irrigation. However, the protectant fungicides would be best applied with a good 'sticker' prior to irrigation allowing enough time for the fungicide to adhere properly.

2. Field Inspections

(Walk through the crop at least once per week inspecting lower leaves for lesions.)

3. First Lesion Found

(Commence spray program).

2. Electronic Monitoring

(Electronic data loggers with sensors within the crop canopy can identify an infection period.)

3. Infection Period Recorded

(Commence spray program at the first infection period recorded after row closure, or at first sign of lesions, whichever occurs first.)

4. Spray Schedule

Apply Score and repeat 10-14 days as per manufacturers recommendations, and then commence protectant program 10-14 days after the last Score application. **Do not apply more than 2 consecutive sprays of Score.**

5. Continue Crop Monitoring

Continue to inspect crop regularly. If disease level increases, or further infection periods are forecast, consider replacing 2 protectant sprays with Score at 10-14 day intervals. **Do not apply more than 2 consecutive sprays of Score.**

Irish blight on leaves

Strategy 2. Paddocks with high disease risk

These are paddocks with:

- a history of poor control of volunteer potatoes or alternative hosts
- adjacent to a likely disease source such as the previous year's potato paddock or cull piles
- downwind of a likely disease source
- less than three years since the last potato crop.

How do these new strategies compare to the current strategy

The current target spot spray programs are mostly initiated at a given time after emergence but before full canopy closure, regardless of whether or not conditions are suitable for infection. This type of regular, clearly defined regime, with the inclusion of Score® sprays as necessary, is a very easy program to implement and is effective for controlling target spot.

Adopting the new integrated management strategy to reduce sprays will often require additional effort and in some years that effort may not be rewarded. However the findings from this work indicate that in many instances it is likely that large savings can be made in the number and cost of sprays and occasionally no sprays at all will be needed.

When should spraying be stopped

This project established that the start time for target spot spray programs can be matched to disease activity, but did not research when spray programs should be stopped However, indications were that spray programs could be stopped much earlier in the season than they currently are without compromising yield, potentially reducing spray inputs even further.

Irish blight warning

The current target spot program of routine protectant sprays also protects crops against infection by Irish blight (late blight). However the new strategies, whilst offering reduced costs from reduced spray applications, leave crops potentially vulnerable to Irish blight. Hence in areas where there is a high risk of Irish blight, such as Tasmania, the options need to be carefully considered.

Irish blight currently can be managed by monitoring crops and applying Ridomil® at the first sign of the disease and then applying protectant sprays thereafter. New overseas strains of Irish blight are resistant to Ridomil and cannot be controlled in this manner. Score does not control any of the strains of Irish blight.

A project to identify management options for Irish blight and assess the risk of these new strains either entering Australia or even developing in Australia has been supported by HRDC. Findings from this project will need to be considered before changing the current approach to target spot control in Tasmania.

Resistant varieties - a strategy for the future

In America some varieties have shown resistance to both blights. Resistant varieties could greatly add to an integrated control strategy and new cultivars should be screened for resistance to target spot and other diseases.

Acknowledgements

We thank HRDC and the Australian Potato Industry for supporting this work. We acknowledge the invaluable input of Angelos Catsipordas in SA and Lois Ransom, A de S Liyanage, Rowland Laurence, Gradon Johnstone and Malcolm Knight in Tasmania.

Undertaking this project would not have been possible without the help and collaboration of the various potato growers who allowed us to conduct experiments on their properties. We also appreciated the help of the staff at the Lenswood Research Centres, SA and Forthside Vegetable Research Station, Tasmania.

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Farm hygiene -potato sheds as a source of disease on seed potatoes

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How many farmers really understand and practice good farm hygiene, particularly when it comes to protecting seed potatoes from contamination? Who can claim that they can prevent their seed from being infected by a range of fungal pathogens before planting?

For example, the silver scurf fungus *(Helminthosporium solani)* has an extraordinary capacity for producing spores in potato stores. In recent research conducted by the North Dakota State University, spore samplers placed in potato stores recorded production of up to 12,000 spores per day where storage temperature was 4ºC and up to 24,000 spores per day where storage temperature was 10ºC.

Spore production increased with increasing traffic in and out of the stores after doors were first opened. Each spore is potentially infective. Clean minitubers were contaminated within a week of being placed in these stores and developed silver scurf within a month.

This and other research points to potato sheds and stores as being an important source of contamination and disease of potato tubers by fungal pathogens, besides the soil in which the potatoes are grown.

The preference for blemish-free, washed potatoes in the market place has put extra pressure on all sectors of the industry to improve quality. Scientists have been asking why some diseases are very common on seed potatoes, even when these potatoes are produced in new ground.

The potato store as a source of infection

In recent studies in the United Kingdom, the pathogens that cause silver scurf, fusarium dry rot *(Fusarium spp.)*, gangrene *(Phoma foveata var. exigua)*, black dot *(Colletotrichum coccodes)* and common scab *(Streptomyces scabies)* were detected in samples of dust taken from the floors of potato sheds and stores. The silver scurf fungus was the most common, being found in 90% of all samples tested.

Spores of *Phoma, Fusarium and Helminthosporium* were detected in air sampled in commercial seed stores. Minitubers were infected by *Helminthosporium* after they were exposed to the air in these stores.

In a study in Australia, the powdery scab fungus (*Spongospora subterranea*) was detected in dust sampled from growers sheds and powdery scab spores were sampled from the air around stocks of scabby potatoes.

Clean bins and clean stores are important in preventing contamination of seed potatoes

This research shows that there is a high risk of contaminating seed potato stocks, as well as bins, machinery and other surfaces, with a number of potato pathogens during normal handling, grading and storing operations in sheds and stores.

Silver scurf - a link with farm hygiene?

Infection in stores may account for the surprisingly high levels of silver scurf found on early generations of seed potatoes.

In a study in one district of Victoria, disease-free minitubers were monitored through early generation seed production. It was found that 30% of G1 generation tubers and 80% of G2 tubers from stocks grown in new ground had silver scurf when removed from cool storage in the spring.

Experience has shown that G1 tubers (progeny of minitubers) from new ground in this district were likely to have had only negligible levels of silver scurf before storage. So the most likely source of contamination is during storage in the potato stores and sheds.

This problem was further highlighted by a survey undertaken by Agriculture Victoria in July 1997 for diseases on the first field grown generation of potato tubers (G1 from minitubers) in the Victorian Certified Seed Potato Scheme.

Of 47 samples taken from 20 growers around Victoria (mostly from cool stores), two thirds were grown in soil that had never previously grown potatoes and one third came from soil that had been cropped with potatoes some time before.

Silver scurf was the most common disease found on tubers (43% of samples). The surprising result was that silver scurf affected tubers were as common in samples from new ground as from old ground (see graph). Again the stores seem to be the logical source of contamination.

The silver scurf fungus is common in soil with a history of potato cropping but is not known to occur in new ground. So the most likely explanation for high incidence of silver scurf on tubers grown in new ground is that minitubers were

contaminated before planting or that their progeny became infected during handling and storage after harvest.

In contrast the black dot fungus is not as easily spread in storage and was not as common on seed grown in new ground in the survey.

This work points to good farm hygiene as being critically important in the management of tuber blemishing diseases.

The importance of hygiene is illustrated by a recent two year study in the UK. In this study, up to 30% of the progeny of disease-free minitubers sprouted in a dirty commercial chitting store had developed silver scurf by harvest time, compared with up to 10% from tubers chitted in cleaned stores. No disease developed on progeny from minitubers that were kept isolated.

Hygiene practices

Hygiene is important for all potato growers, particularly for those using new ground. You should be aware of the conditions which allow disease to build-up in your seed lines and determine the areas of greatest risk.

Minimum good farm hygiene practice on potato farms should include the following

Isolation of seed stocks from commercial potatoes

There is little point acquiring stocks of high quality Certified Seed and then storing them along-side commercial potatoes.

Use clean storage containers

Why put high quality seed stocks in second hand bins that have not been cleaned? Use new bins where possible. Otherwise, use high pressure washing to remove the soil, dust and old potato debris that can carry disease. Treatment with a disinfectant will help kill the spores of some pathogens that can remain trapped in the wood fibres.

Growers who receive their seed in new one tonne bags and then transfer them into unwashed bins are fooling themselves about basic hygiene. If you are a seed grower, do not allow unwashed bins from other farms on your property. Insist that bins are washed.

Clean the store

Remove soil and dust from the shed and store floors and walls. Wash down grading and seed cutting equipment. Research shows that healthy tubers can develop gangrene, dry rot and bacterial soft rot when passed over a grader that has handled contaminated stock.

Concreting the floors of the main working and storage areas is an important step in this process of maintaining a clean environment.

Other steps that can be taken include:

- harvest tubers as soon as possible after plants have died down to minimise the development of silver scurf, black dot and black scurf
- allow skins to cure (>15ºC with good ventilation) after handling to prevent rots during storage
- dry tubers after harvest to minimise activity of the silver scurf fungus
- apply registered post-harvest seed treatments (Tecto Flowable fungicide® or Fungaflor 750wp®) to prevent the spread of silver scurf in storage or protect against dry rots. If you are buying seed, you may specify that your seed grower apply post-harvest fungicides because most seed growers have low volume or ultra-low-volume spray equipment on their grading lines.

Farm hygiene is a neglected area of management. Scottish seed growers are beginning to take up the challenge by handling and storing early generation seed (G0-G3) separately from the rest and by washing and disinfecting floors, walls, ceilings, machinery and storage containers.

There are very few growers in Australia who can really claim that they practice good hygiene. But you can start now!

Acknowledgments

The HRDC has funded work on the management of silver scurf and black dot of potatoes and currently supports a new project on Cleaning and Disinfestation practices for potato farms. The survey of disease levels on G1 seed potatoes was funded by the Victorian Government CQ Potato Project.

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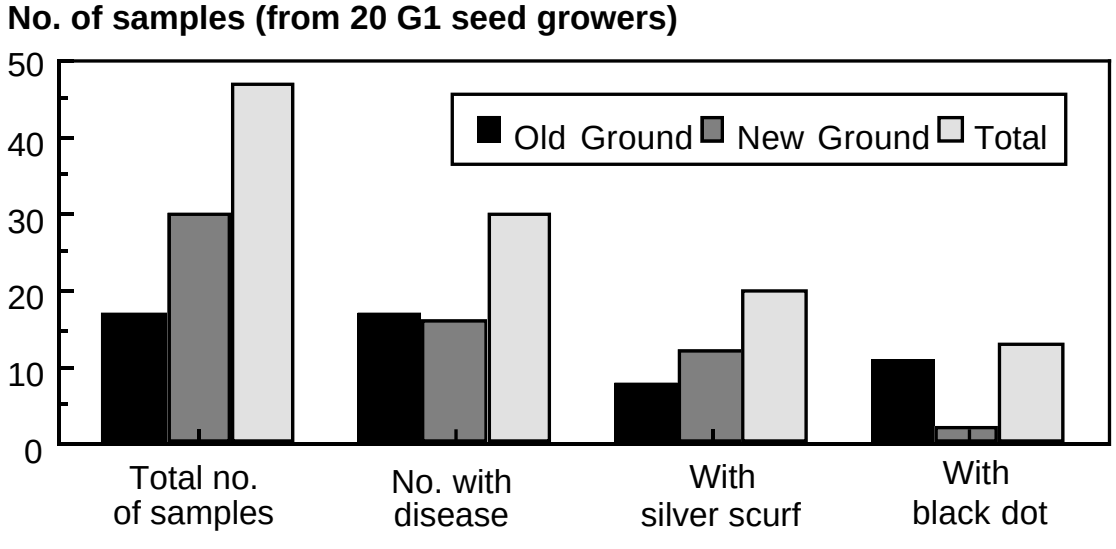
The incidence of samples of tubers with silver scurf and black dot in the first field grown generation of seed potatoes (G1) in the Victorian Certified Seed Potato Scheme

(20 tuber lots were sampled from stores in July 1997)



Potato early dying

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Potato early dying (PED) is a serious disease of potatoes that causes plants to collapse and die prior to full maturity.

It is associated with the combined infection of root lesion nematodes *Pratylenchus spp* and the soil-borne fungus *Verticillium dahliae*. Whilst this problem has been largely unrecognised in Australia, it has been identified as a major disease in the USA for many years.

According to the American work, PED in many cases has not caused a notable decline in yield, but prevented any yield increases that could have been expected from the use of new cultivars, cultural improvements or pest controls. In fact some growers have accepted early maturity as normal.

For the past three years, work has been undertaken to determine if PED and the organisms associated with it exist in Australia. A brief description on some of the results is given in this report.

Symptoms

The most common symptom of PED is similar to natural dying off, that is a gradual yellowing and death of leaves followed by defoliation. Generally these symptoms proceed up the stem which will often remain erect rather than wilting and flopping over after it dies.

Sometimes this occurs on one side of the plant and is often associated with a reddish brown staining within the main stem, obvious only when the affected stems are sliced at an angle near the soil line. Severe symptoms do not usually appear until after flowering and can appear on individual plants, groups of plants or entire crops. In some cultivars a brown staining may also develop internally at the stem end of tubers.

Diagnosis of PED from these symptoms alone is not highly recommended, as they are not distinct from other diseases or nutritional problems causing similar symptoms.

Cause of potato early dying in America

The soil borne fungal pathogen *V. dahliae* in association with the root lesion nematode *P. penetrans* is the primary cause of PED in North America.

It is assumed that while the nematodes feed on the potato roots, they either provide entry points for the fungus or they reduce the natural host defence mechanism of the potato enabling the fungus to attack the roots and grow through the plant.

The fungus can attack the potatoes on its own, but the most severe reaction is where certain species of the root lesion nematodes are also present in the soil.

Although *Verticillium* and *Pratylenchus* are considered to be the main cause of PED in some potato growing areas of North America, other pathogens such as soft rot bacteria (*Erwinia*) and black dot (*Colletotrichum coccodes*) are also associated with similar symptoms.

American studies

In North America, research has shown that the incidence and severity of PED is related to the preplanting population level of the fungus and the nematode. As a result, growers are advised to control the problem only when soil samples contain certain levels of organisms.

For example, problems are likely to occur if *Verticillium* is found equal to or greater than 4 units/gm of dry soil. This threshold drops to 2 units/gm dry soil or less when certain species of *Pratylenchus* are also present at up to 0.1 nematodes/gm dry soil. At these levels, yield reductions are variable but have been recorded as between 30% and 50%.

Australian studies

Except for the work done on *Verticillium* of potatoes in Tasmania in the early 1970's, there have been no studies on this disease complex in Australia. With the help of interstate colleagues, 84 potato paddocks throughout Australia were randomly sampled to determine the extent of the problem and to relate severity of disease to levels of the nematode and fungus.

The results of this sampling, summarised in the table, show that *Verticillium* and *Pratylenchus* are widespread in most potato soils in Australia and that 40% of the 84 paddocks surveyed had levels at or above thresholds recommended in the USA. Keep in mind that threshold levels are yet to be conclusively quantified in Australia, as further research on the effects of climate and soil structure is required.

The main species of nematode detected was *P. crenatus*. This differs to the situation in some American states where *P. penetrans* is the main nematode species associated with PED. There is mounting evidence that *P. crenatus* alone and the other species of *Pratylenchus* that we detected may be affecting potato yields, but further work needs to be done on this aspect.

We also looked at the incidence of *Verticillium* in potato seed tubers and found many samples of certified seed infected with the fungus. This high incidence of infection in seed tubers is of concern, as infected seed tubers are the primary means of introducing the disease into new or fumigated potato growing areas. A separate article discussing these studies will be produced at a later stage.

Incidence of *V. dahliae* and *Pratylenchus* spp. in Australian soils 1995 - 1998

Location	Number of paddocks surveyed	Percentage* of paddocks at threshold	Average (range) number of *Pratylenchus* nematodes per gram of soil	Average (range) units of *V. dahliae* per gram of soil
SA	35	38	1.0 (0 ⩾ 6)	3.3 (1 ⩾ 10)
Vic	12	75	9.2 (3 ⩾ 19)	5.9 (0 ⩾ 14)
NSW	3	33	0.5 (0 ⩾ 1.3)	2.4 (0 ⩾ 9)
Qld	30	31	0.2 (0 ⩾ 1)	4.7 (0 ⩾ 19)
Tas	4	25	0.9 (0 ⩾ 14)	4.8 (0 ⩾ 9.5)

* Based on USA threshold levels

Control

Overseas research has shown that an integrated approach is needed to control this problem and that no single practice will completely control the disease.

Techniques such as resistant cultivars, appropriate crop rotations, irrigation management and removal of plant debris as well as soil fumigation with metham sodium are presently used to control the disease in North America.

However, in Australia research into satisfactory control measures against PED is in its infancy, except for soil fumigation. Fungicide treatment of tubers is unlikely to control pathogens such as *Verticillium* that are deep seated within the tubers.

Fumigation studies

Several field trials were set up to evaluate soil fumigation and its effect on levels of *V. dahliae* and *P. crenatus*. Metham sodium applied at 400 litre/ha decreased the fungi and nematode levels in the soil by 90% and increased the total yield by 26%.

This equated to 9 tonne/ha or approximately $1800/ha (based on $200/tonne). The fumigation cost was approximately $500/ha, resulting in an increased gross profit of $ 1300/ha.

In some of our experiments however no increase in yield followed fumigation. It must be noted that fumigation is expensive and should only be undertaken if yields are declining and that soil tests indicate levels of *Verticillium* and nematodes are high.

Future work

These studies have shown that PED is widespread in the main potato growing region of Australia and that the disease is likely to be reducing yields by 26% to 43% in some areas.

Although overseas research indicated an integrated approach as the best control method, one of the areas that needs immediate attention in Australia is control of *Verticillium* in the potato seed industry.

To achieve this, problem fields in the seed growing areas must be identified, so these fields can be avoided or the soil fumigated to eliminate or reduce the level of the pathogen in the soil.

Further research needs to be undertaken in the following areas:

- reducing *Verticillium* in certified tuber seed by identifying and eliminating soil borne inoculum
- evaluation of resistant or tolerant potato cultivars that could be planted in infested areas
- irrigation management (eg. withholding irrigation at certain stages of plant growth has controlled the disease overseas)
- removing infected plant debris after harvest to reduce the level of disease carryover
- fumigation by chemical or green manure crops (biofumigation)
- biological control with antagonistic fungi and bacteria.

PED is a complex disease that at present is only controlled by fumigation. With our understanding of PED steadily improving and with further research on the above goals, implementation of viable IPM systems using improved management techniques should eventually be possible.

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HRDC

Technology Transfer Project update

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The Australian Potato Industry Technology Transfer Project has been going since late 1996 so it is timely to look at the progress that has been made.

The objectives of the project were to improve adoption of technology from the R&D program, improve communication within the industry and develop a national Code of Practice for Potato Cyst Nematode (PCN).

The Code of Practice component was later expanded to include other diseases to make it more relevant to the day to day needs of farmers and to increase the likelihood of it being adopted. This part of the project I will talk about in a later article.

Starting with the basics

To tackle such a difficult task it has been important to focus initially on the basics and develop a solid foundation for future improvements. This has been done by looking at how the industry works from three different points of view - awareness, access and understanding.

To improve communication people need to be aware of what is going on. This involves having a good distribution system and information going out regularly that will be of interest and value to the industry.

A second important issue for many people is the ability to access information when they need it. *"Who do I contact about market prices or where can I find results from R&D done on this disease?"*

A third issue is the need for people to receive information in a language they understand and with a focus on their needs.

The changes implemented take into account the above issues and are based on feedback from 150 interviews and follow-up sessions carried out around Australia in late 1996 and the first half of 1997.

The following is a brief summary of progress to date. As it is not possible to do all the work myself a large part of my role is working with others to develop solutions.

Eyes on Potatoes

Nathalie Jarosz, Editor of *Potato Australia*, and I started *Eyes on Potatoes* to address the need for a more regular flow of information about what was happening in the industry and provide another outlet for information coming out of the R&D programs. This need had been identified by the Australian Potato Industry Council (APIC).

With *Potato Australia* we now have a national publication coming out each quarter.

To free up Nathalie's time for editing, an Advertising Manager was engaged and a support group was set up consisting of state representatives (see page 4). The role of the support group was to pick up on issues of interest from each state and feed these back in so they can be reported on. This system is also used for *Potato Australia*.

To make it easier for industry to become aware of and access Australian and overseas information services and products, articles on publications, internet sites and other services have become a regular part of *Eyes on Potatoes.*

Potato Australia

The feedback from interviews I conducted across Australia indicated that people were generally happy with *Potato Australia* and there were only minor changes needed.

The main concerns raised were that some articles were difficult to read (too much jargon, not written for the audience) and did not always have a take home message. As a result of those comments Nathalie and I have focused on improving the quality of the articles.

We have started a system where either a brief summary or a full article has been requested for *Potato Australia* from each R&D project in progress or that has been completed in that year up to July.

Distribution system

Producing information is fine but if the people who need it do not get it then it is of little value to the industry. It is therefore important to have good mailing lists and a coordinated distribution system. These things do not just happen. They involve a lot of work.

The state farmer mailings lists have undergone a major upgrade with most of the work being done through state groups (see page 4). Except for a few problem areas which are currently being addressed, we believe most regions are pretty well covered. The main challenge from now on will be to keep the lists up to date and fill in any remaining gaps as we become aware of them.

Besides farmers there are also a number of other people in the industry that need to be kept informed of developments. People such as consultants, agribusiness advisers and government advisers are just some of the people who work with farmers. If farmers are to receive good quality advice, these people need to be kept well informed. To date 728 people have been identified.

Information directory

An information directory will be available soon and will contain a wide range of industry contacts, information on publications and where to obtain them, summaries of HRDC final reports from projects, internet guide, industry statistics and information on industry groups.

Management guides

Information on most potato topics is generated over a period of time so every now and then we need to consolidate it into a package so we can take full advantage of it. This is particularly important if information from R&D programs is to be effectively used and changes in market needs are to be taken into account.

At present I have been working with several groups to assist them in producing management guides that will provide important references for the Australian Potato industry.

Internet

A lot of people who do not use the internet wonder why it is so popular. The answer is simple. *What other information service is open twenty four hours a day, can be accessed from the home relatively cheaply and provides access to information and services from a large number of organisations from around the world.*

The internet has had a massive impact on the way we look at dealing with information. It offers people the opportunity to obtain information when they need it rather than when someone else wants to provide it. It also enables information to be updated easily and relatively cheaply.

The challenge though is to set up an internet site that is truly useful. Anyone who uses the internet will no doubt agree there is a lot of rubbish in between the good bits.

My role is to work with others to facilitate the effective adoption of this technology so that it offers a truly valuable service for the potato industry.

Potato Internet Starter Pak

The Potato Internet Starter Pak was developed last year to provide an easy way of accessing potato internet sites. The Starter Pak provided the opportunity for a wide range of people in the industry to look at what was already out there so that when we start asking what is needed, people would be more aware of what is possible.

There are currently 74 users of the Starter Pak. These people will soon be surveyed to get feedback on how to improve it.

To take us to the next stage a project has been initiated by the Department of Primary Industries and Fisheries, Tasmania and Primary Industries and Resources South Australia to look at the opportunities available and what we need to consider in setting up an internet service.

See the project summary - *Facilitating the introduction of electronic information products and services to the Australian Potato Industry* in the article New projects approved by HRDC (on page 13).

Potato Archives

When I looked at the information coming out of the R&D projects a lot of it was going in *Potato Australia* and other publications such as industry newsletters, workshop notes and information leaflets. There was also the HRDC reports that are produced at the conclusion of each project. In short there were bits and pieces all over the place.

A proposal is currently being put together to pull this information together and put it on a computer CDROM.

The CDROM has several advantages. It is relatively cheap, CDROM players have become standard on most computers and they hold an enormous amount of information. To produce the equivalent document in printed form would be very expensive and not very easy to use as it would be very large.

Another advantage is, if they are designed properly, the information can be searched for easily. Ask for information on powdery scab and all the documents with powdery scab in the title will be listed. Click on a document in the list and the document is displayed. So the CDROM will become the industry library for a range of publications.

Working with researchers

Working with researchers on developing new projects, packaging up work when projects are nearing completion and encouraging progress to be reported has been an ongoing task.

APIC R&D Committee

My role on the committee is as an adviser to assist the industry representatives with the technology transfer aspects of projects.

Conclusion

So when the changes take effect farmers should be better informed, able to access information more easily and the information they do receive from the national program will be easier to understand. ■

Identified by their fingerprints!

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Meet the potato private eyes. They're a team of scientists who're playing detective to prevent incorrectly named cultivars from being planted or supplied along the production chain.

Using DNA fingerprinting techniques, Agriculture Victoria scientists are able to identify potato cultivars, which can be mixed at any stage of the production chain; from the tissue culture laboratory to the production of foundation and certified seed.

A consequence of mixing cultivars early in the production chain can result in a crop not being certified and in diminished returns.

The ability of scientists at the Institute for Horticultural Development (IHD) Knoxfield to rapidly distinguish and identify potato cultivars reduces the potential of mixed or incorrect varieties.

Until recently, the only way the industry could tell the difference between cultivars was by close examination of their characteristics; such as leaf size and shape, flower colour and tuber shape. This requires extensive observation of plants until maturity and can be further complicated by location and environmental factors, which can influence the appearance of the plants and make it difficult to distinguish cultivars. For example, *Exton* can be confused with *Sebago* at the flowering stage.

Over the last decade, laboratory techniques have been developed which can rapidly identify cultivars and distinguish between similar looking cultivars. These techniques detect differences between the genetic material, or DNA, of individual cultivars. Such differences are unique for each cultivar and are often referred to as DNA fingerprints. The idea is similar to using fingerprints to distinguish and identify humans.

How to get a potato DNA fingerprint

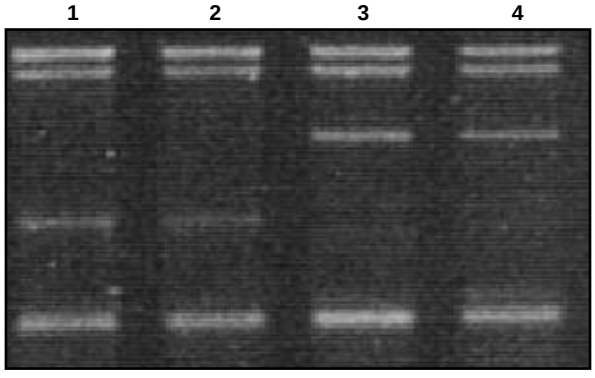
There are three individual steps involved in obtaining a DNA fingerprint:

1. Extraction of DNA from a plant cell from the potato tuber or plant
2. Multiplication of DNA using Polymerase Chain Reaction (PCR). DNA is made up of two strands, which can be separated into single strands by heating. Scientists remove one strand and add an enzyme (**DNA polymerase**), which builds a new DNA strand. These strands are then doubled (**chain reaction**). By automating this procedure, in excess of a billion copies of DNA can be produced in 30 cycles of PCR, which can take several hours.
3. Separation of DNA fragments through a gel and a photographic record is taken of the DNA fingerprint.

The presence or absence of particular bands in the photograph enables the cultivars to be identified.

PCR is a technique which can be used for DNA fingerprinting for many different plants, but the work being done at Knoxfield is specific for potato cultivars.

Potato cultivars X and Y are morphologically indistinguishable



Lanes 1 and 2 are a DNA fingerprint of cultivar X which is clearly different from the DNA fingerprint of cultivar Y in lanes 3 and 4.

What's in it for you?

DNA has a number of advantages:

- it can distinguish between similar looking cultivars
- it is extremely sensitive and has the potential to identify clones from individual cultivars
- it is not influenced by location and environment
- testing can be done at any time of the year
- results can be obtained in a few days

The ability to identify cultivars or to distinguish between cultivars that look alike offers an aspect of quality assurance for tissue culture labs and to growers. Also seed schemes can benefit by having DNA fingerprints for all new cultivars entering the schemes.

DNA fingerprinting to determine cultivar mix-ups is available to industry through Crop Health Services at IHD Knoxfield.

The next part of the project is to prepare a database of DNA fingerprints to assist with identification of commonly grown potato cultivars.

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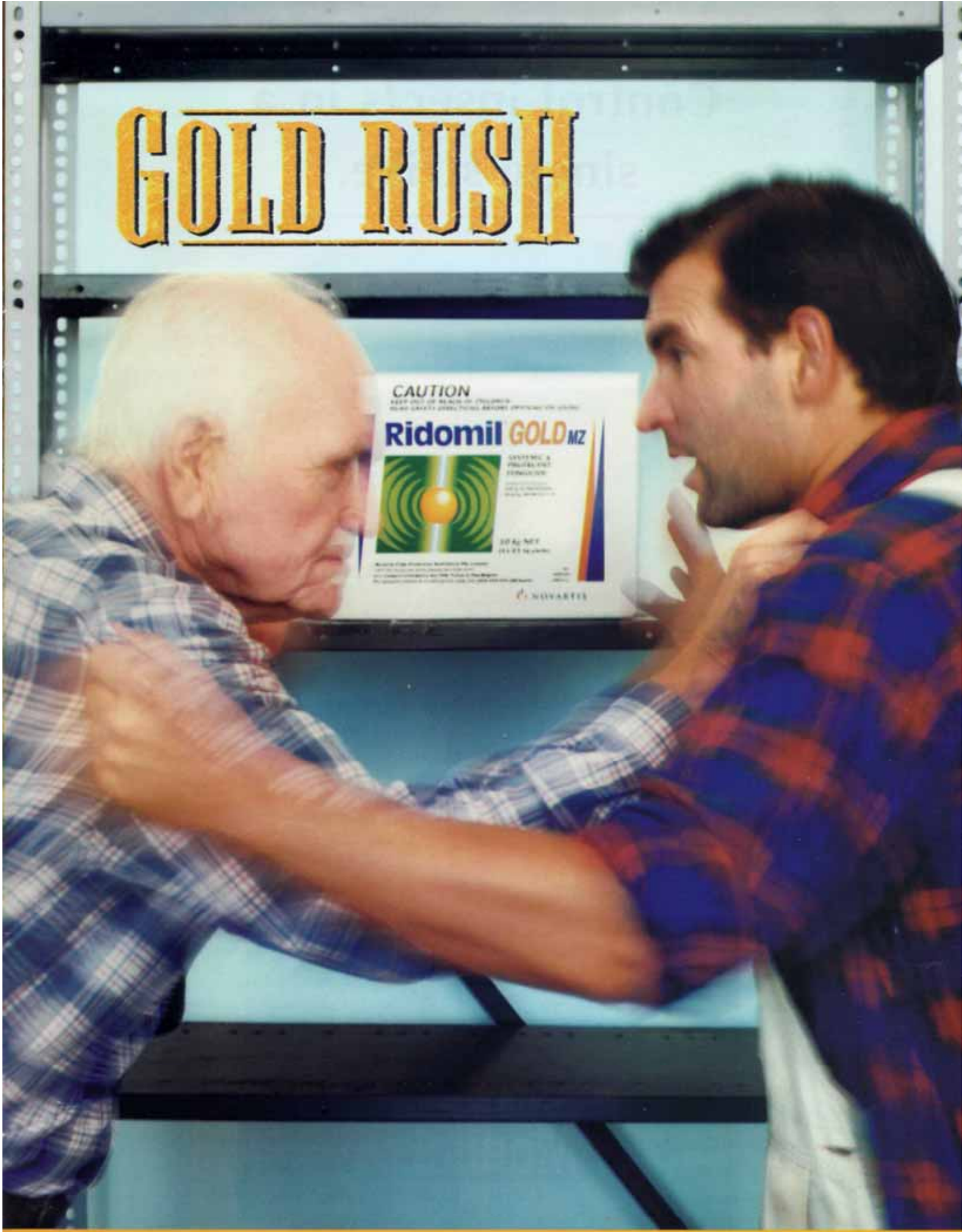
HRDC



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