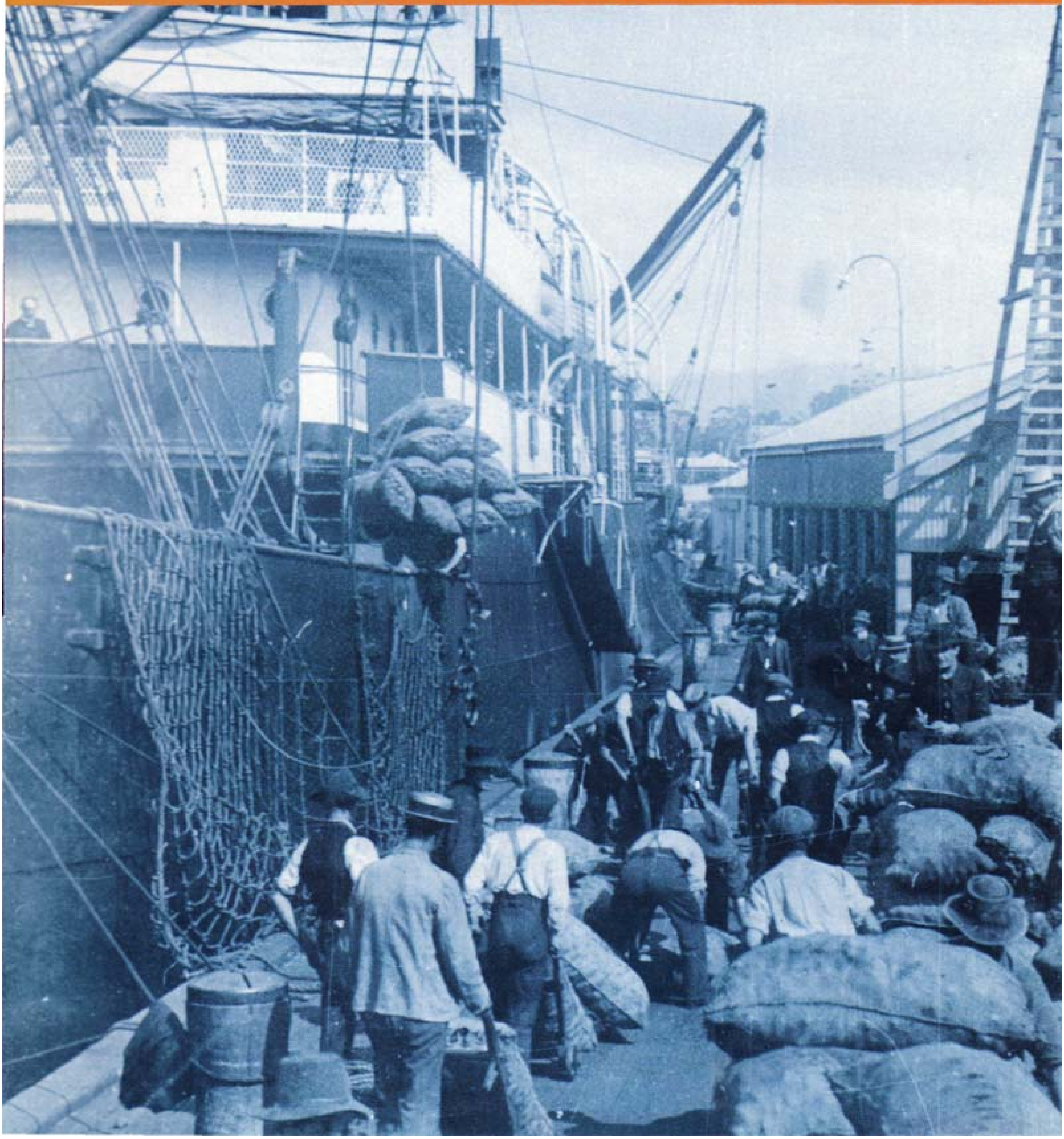
Potato Australia

PUBLISHED BY THE AUSTRALIAN POTATO INDUSTRY COUNCIL

VOLUME 8 SEPTEMBER 1997 ISSN 1036 – 8558




SCORE KEEPS YOUR POTATOES GROWING LONGER.

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Editorial

Russell Sully, in his story starting on page 12, asks whether we are going to allow the Australian potato industry to decline or will we do what it takes to expand and take advantage of the emerging opportunities in world trade.

It is interesting then, to reflect on our front cover photo and contemplate the changes in the potato industry over 85 years. Obviously the way we do things has changed, but perhaps what we do is still much the same.

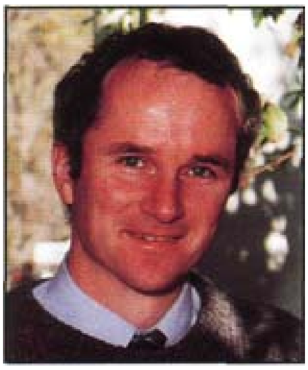
In 1912 Australian growers sent large quantities of potatoes to the Sydney markets. Eighty five years later Sydney is still a major market for our produce. But now we are also thinking about shipping potatoes to our Asian neighbours. Just as early in the century Tasmanian growers looked to Sydney as a growth market, Australian growers are now looking to Asia to provide expansion opportunities for the industry.

The quality of produce on arrival at its destination was no doubt a big concern then, just as it is today. In those days potatoes were a regular part of most meals. Today there are many other options besides potatoes. We have to compete for the consumer dollar.

Our greatest challenge will be in producing what the customer wants and if early indications from Eric Coleman's Quality Assurance project is any guide, consumers do respond. The question is will we respond as an industry.

The cover photo well illustrates just how labour intensive the potato industry was at the turn of the century. As we look to the next century, the future of our industry still depends on the actions of the people in it.

Nathalie Jarosz - Editor



Leigh Walters – Assitant Editor

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Contents

ACKNOWLEDGEMENT:
Our thanks to the Devon Historical Society Inc. and the Devonport Maritime Museum Inc. for use of the fascinating cover photo.

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

Chairman's message

WAYNE CORNISH
is the Chairman of the
Australian Potato Industry Council

Having just returned from Sydney where Max Walker and myself attended a HRDC sponsored Combined Horticultural Research & Development meeting, I remain convinced the APIC whole of industry approach to research and development strategies, project initiation, and levying is clearly the best model available.

Our APIC Research and Development Committee, which is structured on full industry participation, utilising the skills of an independent Chairman, is light years in front of most other industries.

The quite obvious lack of consultation between some commodity advisory groups and industry was of concern to us and I hope the same insular approach is never adopted by the potato industry.

Senator David Brownhill delivered a strong message to industry urging it to resist the temptation to try and extract levy funding from the corporations to fund agri-political agendas. Failure to comply with the warning will, I believe, put the government dollar for dollar matching funding and the collection function by the Department of Primary Industry and Energy at real risk.

Clearly, funding raised for specific purposes via compulsory levy must be transparent and beyond reproach, both in terms of the levy payer and the tax payer.

I am happy to say APIC has never attempted to fund itself through any doubtful fund applications. Any funding received by APIC from HRDC is subjected to all the proper tests and meets the government guidelines.

APIC Research and Development Committee met in March and agreed to

an impressive project portfolio. This edition of Potato Australia contains important information on many of these projects.

I believe the long saga of MPC's of cadmium in potatoes may soon be coming to an end. APIC, with the National Food Authority, has agreed on a Cadmium Minimisation Strategy. Part of the strategy includes bringing Australian acceptable levels in line with the world CODEX standards.

My thanks goes to all those within the industry and externally who have played a major role in developing our very credible position.

Another saga has been the protection of data held by chemical companies prior to the release of new generation chemicals onto the Australian market. Much negotiation has taken place and now agreement has been reached between the parties which will allow the chemical companies to protect their investment and satisfy industry's need for new safe and effective chemicals.

One wonders how long the industry will have to wait to see the advantages of genetic engineering research flow through to growers, processors and consumers. Pressure must be applied by APIC and others to see these environmentally friendly and more efficient practices being made available to industry.

This season in particular will see pressure on growers in relation to water allocation and use. Let's hope we start to see better weather patterns to ease those pressures.

The two industry initiated projects looking at Quality Assurance and Technology Transfer have been going for nearly 12 months.

The Quality Assurance or QA project at Gatton in Queensland is highlighting what can be done, and with little cost, to improve the quality of potatoes reaching our food outlets. The pilot trial is producing some impressive results.

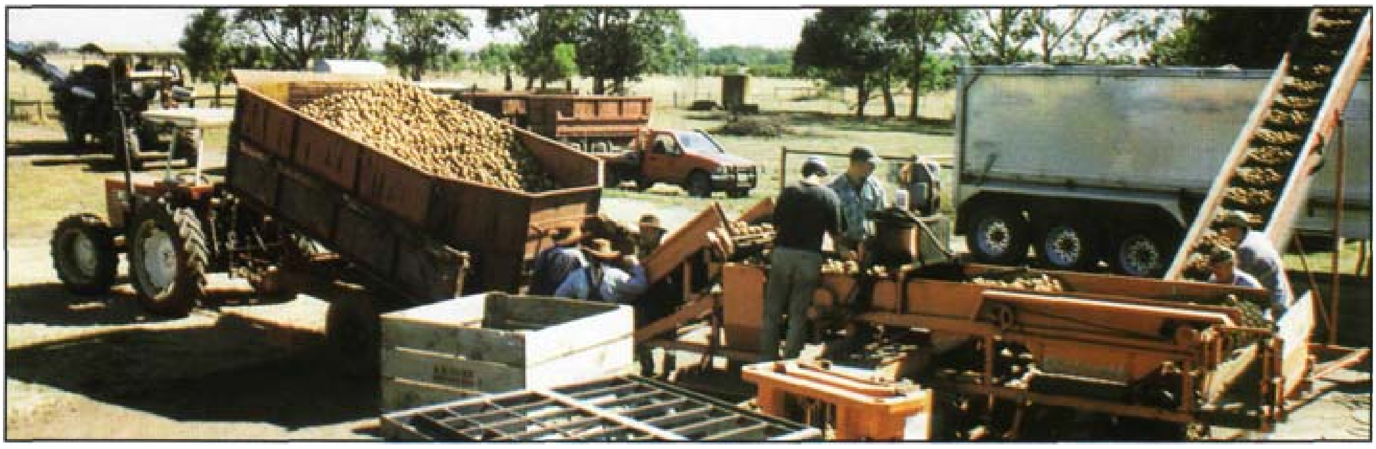
The employment of Leigh Walters through the Technology Transfer Project has meant we can focus on improving communication within the potato industry.

Leigh has been working hard with industry groups around the country to identify and address communication problems. Although early in the project, Leigh has worked with Nathalie Jarosz (Editor of Potato Australia) to produce Eyes on Potatoes, sorted out problems with mailing lists and will be soon be sending out an information directory for the industry.

Again, my thanks to those who diligently compile Potato Australia, and those who help the publication through advertising and sponsorship.

Best wishes
for a successful season. ■

Bulk handling and grading potatoes for crisp processing on the Giles family farm, Koo Wee Rup, Victoria



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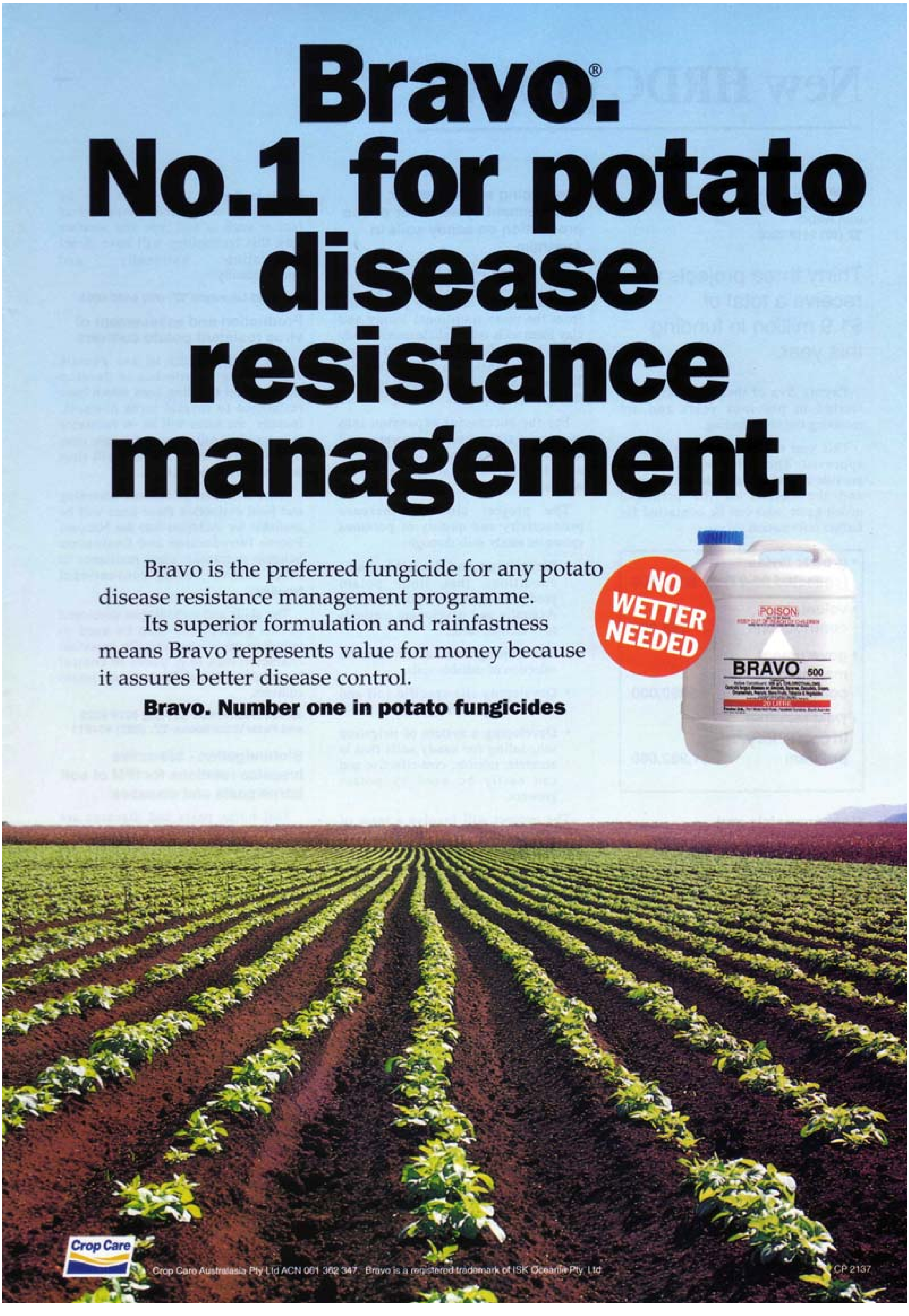
HRDC Potato R&D Projects for 1997-98

Project title	Chief Investigator	☎
Crop management		
Irrigation management in integrated crisping potato crops of South Australia	Pam Strange.Scholefield Robinson Horticultural Services Pty Ltd	08 8373 2488
More economic and environmentally responsible use of phosphorus fertiliser in potato cropping on krasnozem soils	Dr Leigh Sparrow,	03 6336 5379
Sustainable potato production in highland NSW - Stage III	Sandra Lanz, L anz Agricultural Consulting	04 8836 318
Developing soil and water management systems for potato production on sandy soils	Ben Dowling, Primary Industries SA	08 8724 2913
Remote sensing as an aid to horticultural crop recording and husbandry	Dr Rowland Laurence, Tas Institute of Agricultural Research	03 6430 4901
A national strategy to reduce cadmium accumulation in potato crops	Dr Mike McLaughlin, CSIRO Division of Soils	08 8303 8433
Mechanisms of cadmium accumulation by potato tubers	Dr Mike McLaughlin, CSIRO Division of Soils	08 8303 8433
National Potato Improvement & Evaluation Scheme		
Breeding fresh market potato varieties - Stage 2	Dr Roger Kirkham, Agriculture Victoria	03 5957 1204
Breeding French fry potato varieties - Stage 2	Dr Roger Kirkham, Agriculture Victoria	03 5957 1204
Breeding crisp potato varieties - Stage 2	Dr Roger Kirkham, Agriculture Victoria	03 5957 1204
Evaluation and development of new potato genotypes - South Australia	Dr Chris Williams, SA Research & Development Institute	08 8389 8808
Potato cultivar accession and testing in Tasmania	Dr Rowland Laurence, Tas Institute of Ag Research	03 6430 4901
Selection and evaluation of potato cultivars in Queensland	Dr Ken Jackson, QLD Department of Primary Industries	07 5462 1122
Potato breeding & cultivar evaluation - Western Australia	Peter Dawson, Agriculture Western Australia	08 9892 8444
Potato cultivar evaluation in Victoria and New South Wales	Dr Roger Kirkham, Agriculture Victoria	03 5957 1204
Production and assessment of virus resistant potato cultivars	James Hutchinson, Agriculture Victoria	03 9210 9222
Technology transfer of new potato cultivars	Dr Roger Kirkham, Agriculture Victoria	03 5957 1204
Pest, disease & weed management		
National strategy for the management of Western Flower Thrips and tomato spotted wilt virus	Dr David Cook, Agriculture Western Australia	08 97806231
Influence of rotation and biofumigation on soil-borne diseases of potatoes	Dr Dolf de Boer, Agriculture Victoria	03 9844 1635
Biofumigation - bioactive Brassica rotations for IPM of soil borne pests and diseases	John Matthiessen, CSIRO Division of Entomology	08 9333 6641
Investigation on common scab disease of potatoes and development of control methods	Dr Hoong Pung, Serve-Ag Pty Ltd	03 6427 0800
Potato pink rot control in field and storage	Dr Trevor Wicks, SA Research & Development Institute	08 8303 9563
New chemical treatments for fungal diseases of seed potatoes	Dr Dolf de Boer, Agriculture Victoria	03 9844 1635
Control of black nightshade and other weeds in potatoes	Ian Macleod, Serve-Ag Pty Ltd	03 64 270800
Postharvest		
Sprout suppression for the French fry potato industry	Andrew Baker, Sunrise Agriculture Pty Ltd	03 6427 8553
Development of a quality assured production and marketing system for fresh potatoes	Eric Coleman, QLD Department of Primary Industries	07 5462 1122
Seed development		
Aphid monitoring in the Scott River potato seed growing area of south-west Western Australia	Francoise Berlandier, Agriculture Western Australia	08 9368 3249
The economics and agronomy of round seed potato production	Dr Rowland Laurence, Tas Institute of Agricultural Research	03 6430 4901
Development and implementation of National Seed Potato Certification Standards	Dr Rowland Laurence, Tas Institute of Agricultural Research	03 6430 4901
DNA fingerprints and cryopreservation of potato cultivars for improved quality assurance	James Hutchinson, Agriculture Victoria	03 9210 9222
Technology transfer		
Information packages and decision support software for improved nutrient management of potato crops	Norbert Maier, SA Research & Development Institute	08 8303 9423
Coordinating technology transfer in the Australian potato industry	Leigh Walters, SA Farmers Federation	08 8232 5555
Production and distribution of Potato Australia	Max Walker, Australian Potato Industry Council Inc	03 6427 9696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New HRDC projects

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

Thirty three projects will receive a total of $1.9 million in funding this year.

Twenty five of these projects have started in previous years and are receiving ongoing funding.

This year there are ten new projects approved. The following summaries provide an introduction to the projects and the details of the principal investigator who can be contacted for further information.

grower levies (collected 96-97)	**$957,000**
voluntary contributions	**$65,000**
government matching contribution	**$960,000**
Total invested in potato levy program	**$1,982,000**

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

Krasnozems (red soils on basalt) fix or 'lock up' more phosphorus than most other Australian soils. Up to ten times more phosphorus is applied to potatoes than is removed in the tubers at harvest.

This project will see if phosphorus can be more efficiently used to produce high yielding, good quality potatoes. This will save money and reduce cadmium additions to soil.

Field and laboratory trials will investigate new ways of placing small amounts of phosphorus fertiliser close to the seed. Different phosphorus fertilisers will also be assessed such as the ammonium phosphates which have proved superior as starter phosphorus fertilisers in other crops.

Leigh Sparrow ☎: (03) 6336 5379

Developing soil and water management systems for potato production on sandy soils in Australia

Over the last twenty to thirty years in Australia there has been a large and sustained move in potato production from the more traditional loamy and clay loam soils onto light textured sandy soils. Most of the current and future industry expansion in NSW, Victoria, Tasmania, SA and WA is likely to be on the lighter, sandy soils.

For the successful expansion into these new areas several important soil and water management issues which affect yield and quality need to be addressed.

The project aims to increase productivity and quality of potatoes grown on sandy soils through:

- Identifying and describing soil conditions that limit potato production on light textured soils in Australia and developing methods to overcome them.
- Developing indicators for the selection of suitable soils.
- Developing site specific soil and water management systems.
- Developing a system of irrigation scheduling for sandy soils that is accurate, reliable, cost-effective and can easily be used by potato growers.

The project will involve a team of specialists in soil science, plant nutrition and irrigation.

Ben Dowling ☎: (08) 8724 2913

Remote sensing as an aid to horticultural crop recording and husbandry

Recording of precise crop location, paddock rotational history and crop performance are becoming an increasingly important part of crop management and product quality assurance.

The project will investigate the potential of satellite imagery technology to recognise and differentiate between horticultural crops, predict yield and monitor crop growth and health status. This will provide industry with the information needed to assess the value and future use of this technology.

Tasmania will host this pilot project as a wide range of horticultural crops are grown in intensive cropping sequences. If it is found that crops can be consistently recognised irrespective of factors such as soil type and weather then this technology will have direct application nationally and internationally.

Rowland Laurence ☎: (03) 6430 4901

Production and assessment of virus resistant potato cultivars

The project aims to use genetic engineering approaches to develop cultivars and breeding lines which have resistance to several virus diseases. Initially the focus will be on resistance to potato leaf roll virus and potato virus Y, and then on tomato spotted wilt virus and possibly potato virus X.

After extensive greenhouse screening and field evaluation these lines will be available for inclusion into the National Potato Introduction and Evaluation Scheme to transfer virus resistance to other cultivars using conventional breeding.

The skills and technologies developed in this project can then be used to introduce other agronomically important characteristics (e.g. genes to control bacterial and fungal diseases) into potato cultivars.

James Hutchinson ☎: (03) 9210 9222
and Peter Waterhouse ☎: (062) 464911

Biofumigation - bio-active brassica rotations for IPM of soil borne pests and diseases

Soil-borne pests and diseases are significant problems in the potato industry. In some areas soil fumigants are used for their control, but this is expensive and may not be sustainable in the longer term. Many compounds related to the active product of the soil fumigant metham sodium occur to varying degrees in various Brassica species.

The project will investigate the natural occurrence of the compounds in brassicas and their effects on pests and diseases. The aim is to take best advantage of their apparent natural fumigating effects for suppression of soil-borne pests and diseases. This will be done by selecting appropriate types for use as a crop or a green manure within a rotation.

John Matthiessen ☎: (08) 9333 6641

Potato pink rot control in field and storage

Pink rot is a soil and tuber borne disease which has recently caused

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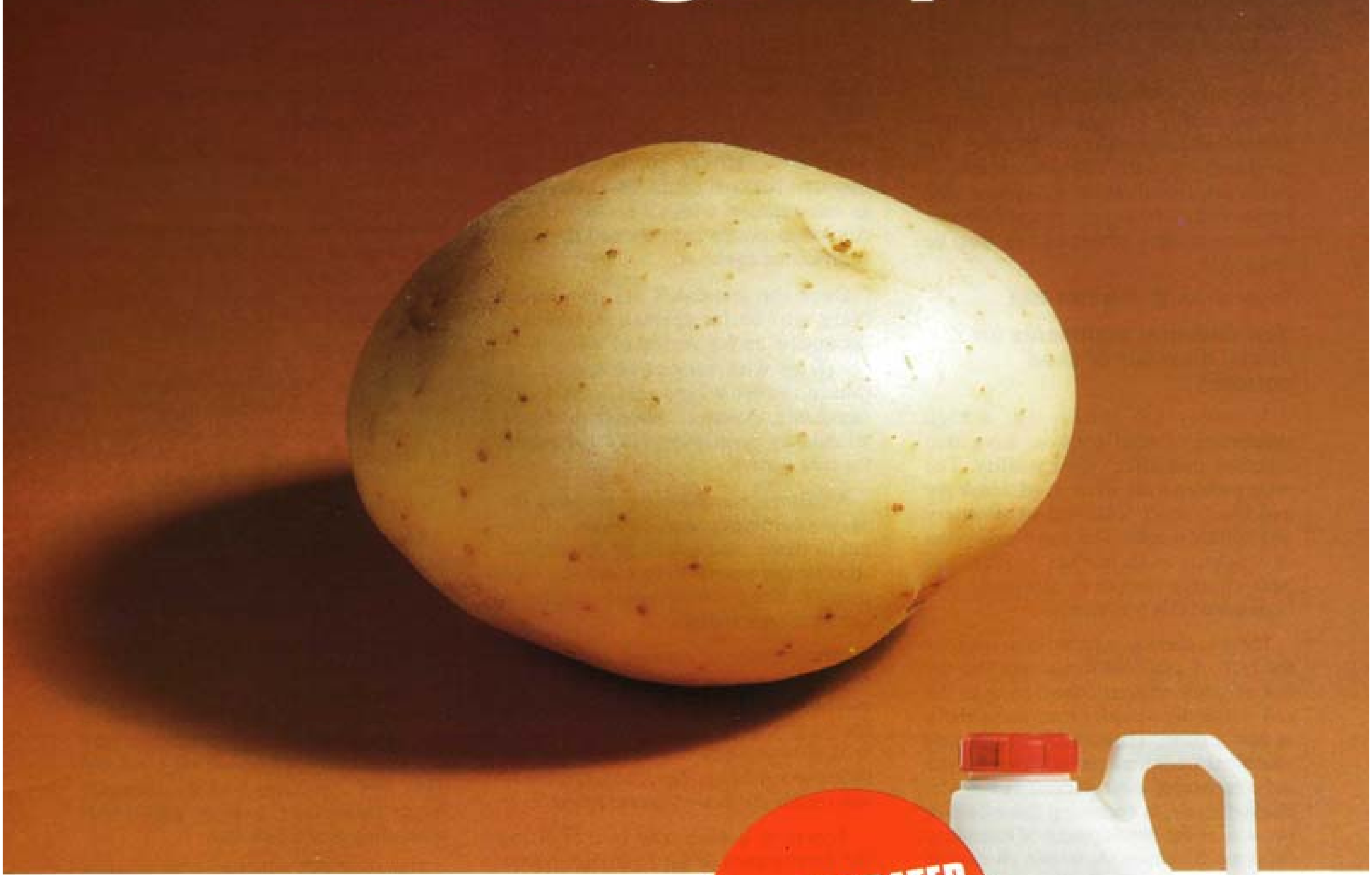

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serious economic losses and could be a major factor limiting further expansion of the industry in some areas. In the south east of South Australia, yield losses of more than 50% and financial losses in excess of $45,000 have been reported in some years. Major losses also occur during long term storage of potatoes destined for processing.

Growers consider that the incidence of pink rot is increasing. Of particular concern is the possibility that the disease is being introduced into new areas on infected seed tubers. Further spread of the disease could cost growers more than $9,000/ha.

The aim of this project is to develop sustainable methods of controlling pink rot in the field and to eliminate losses occurring in storage. Greenhouse, laboratory and field studies will be undertaken to gain a better understanding of the disease. In conjunction with the evaluation of cultivars for disease resistance and improved disease management, effective control strategies can then be developed.

Trevor Wicks ☎: (08) 8303 9563

New chemical treatments for fungal diseases of seed potatoes

A survey has shown that a high proportion of seed potatoes have skin diseases that affect their quality. The main problems are silver scurf, black dot and black scurf followed by powdery and common scab. The rapid expansion of washed, fresh market production, particularly in new ground, has highlighted this problem.

There is serious industry concern over the lack of available treatments and the risk of certified seed contributing to the soil-borne disease problem, particularly in new ground. There are few registered chemical treatments available and the only registered post-harvest fungicide, thiabendazole, is becoming less effective because of the development of resistance in some diseases. A wider choice of treatments that are effective against the different diseases to reduce the risk of resistance is needed.

This project will gather the latest overseas information on the management of seed and soil-borne diseases, evaluate new chemicals being developed, or in use overseas and test them against the major fungal diseases of seed potatoes under local conditions.

The project aims to facilitate registration of these new treatments in collaboration with the agrochemical companies and industry and will communicate information on the management of seed-borne diseases nationally.

Better quality seed potatoes and a reduced risk of disease spread on seed, will benefit both domestic and export markets.

Dolf de Boer ☎:(03) 9210 9222

Development and implementation of National Seed Potato Certification Standards

National seed potato certification standards and terminology will be developed to overcome the confusion created by the current situation where each state has a different certification system.

This provides an opportunity to introduce the latest overseas seed certification techniques and new disease detection procedures.

The project will be administered by the Australian Potato Industry Council (APIC) with day to day management by Agriculture Victoria. The project will employ a National Seed Potato Standards Officer to develop and negotiate national certification standards in consultation with all sectors of the Australian potato industry and the state certification agencies.

Once the standards are developed there will be interpretative manuals produced and a series of education programs with various sectors of the potato industry (growers, certifiers, merchants, exporters, buyers) to ensure all industry participants fully understand the new system.

A national accreditation program for people certifying seed potatoes will be put in place and it will be determined whether there needs to be a national seed potato body to oversee uniform certification standards.

Development of national certification standards offers the opportunity to establish a reliable quality benchmark for Australian and overseas buyers. It will also provide the opportunity for improved quality, product uniformity and credibility in seed potato markets.

Access to quality seed is critical for the development of the Australian potato industry.

Rowland Laurence ☎*:* (03) 6430 4901

DNA fingerprints and cryopreservation of potato cultivars for improved quality assurance

Identifying different types of potatoes in a breeding program is not always an easy task. Methods that can rapidly identify and distinguish cultivars can reduce costs in the breeding program which will benefit the seed scheme and ultimately the whole potato industry.

For many reasons, cultivars can become mixed up and this can occur at any part of the production chain from the tissue culture laboratory to the grower. Additionally, some cultivars in the schemes are not required as often as others and considerable expense is incurred during their routine maintenance.

The objectives of the project are to develop methods that;

- can rapidly identify potato cultivars based on DNA fingerprints
- will reduce maintenance of cultivars kept for long periods through the use of cryopreservation (maintaining shoot tips in liquid nitrogen)

This project will be closely linked to the various seed schemes by each state being represented on the project team.

James Hutchinson ☎: (03) 9210 9222

The economics and agronomy of round seed

While cut seed potatoes have been regarded as an adequate low cost option there are problems in their use. Seed can be exposed to diseases during cutting and irregular shapes of seed pieces can result in uneven placement in the field. These are seen as increasing problems in the context of escalating overall production costs.

There is general agreement that significant improvements in ware crop profitability may be gained from the use of larger seed, which may make the economics of round seed more attractive.

The potential for Australian seed producers to supply expanding markets in South East Asia also requires the production of whole round seed.

This project will compare, through field trials conducted in Tasmania, Western Australia and Victoria, the effect of seeding rate, seed size, seed type, physiological age of mother seed and hormonal applications on yield and tuber size distribution of the currently most important export and local processing potato cultivars.

The work will only target information which is currently unknown for these cultivars and combine the results into an economic assessment of the practice for both local and export markets.

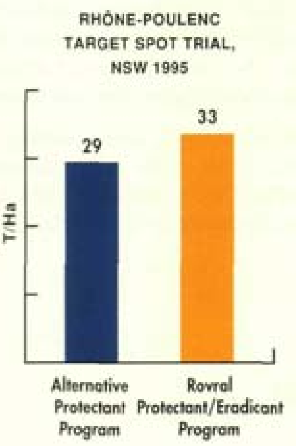
Recommendations for growing mother seed will be prepared for growers throughout Australia.

Rowland Laurence ☎: (03) 6430 4901

HRDC

■

ABOVE GROUND



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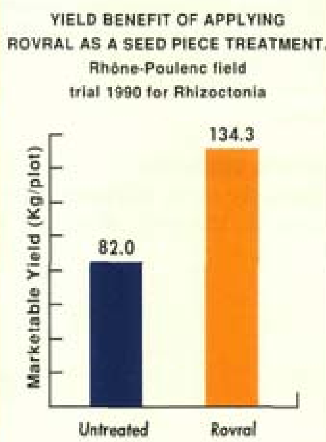

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Potato industry at the crossroads - decline or massive expansion

RUSSELL SULLY
is the Industry Manager (Potatoes)
Institute for Horticultural Development
Agriculture Victoria
☎ (03) 9210 9385

Agriculture Victoria has been conducting a case study into the international competitiveness of the potato industry.

This study has a view to facilitating the preparation of a plan for the future direction and development of the industry.

The project has focused on the fresh industry as it is facing major problems. Significant challenges and opportunities have also been identified for the fresh, processing and seed sectors of the industry in both domestic and export markets.

Current situation

Recently fresh potatoes have been facing a reduced demand on an oversupplied domestic market with growers in many areas leaving potatoes in the ground at the end of the season. Part of the reduced demand is due to increased competition from rice and pasta which offer consumers convenience and reliable quality.

Internationally the Australian potato industry needs to become competitive on quality and price. If this cannot be achieved, the industry will go from being an international threat to other suppliers to becoming a market opportunity for them.

Australia currently produces approximately 1.2 million tonnes of potatoes annually, while there are predictions that the Asian demand for potatoes could increase this to four million tonnes by the year 2000.

Recently, there have been enquiries from overseas markets for a total of 600,000 tonnes of potatoes a year.

"The industry is destined for decline or massive expansion."

Consumer trends

The HRDC funded research by Richard Marketing in 1994, identified a number of consumer trends, attitudes and perceptions of fresh market potatoes:

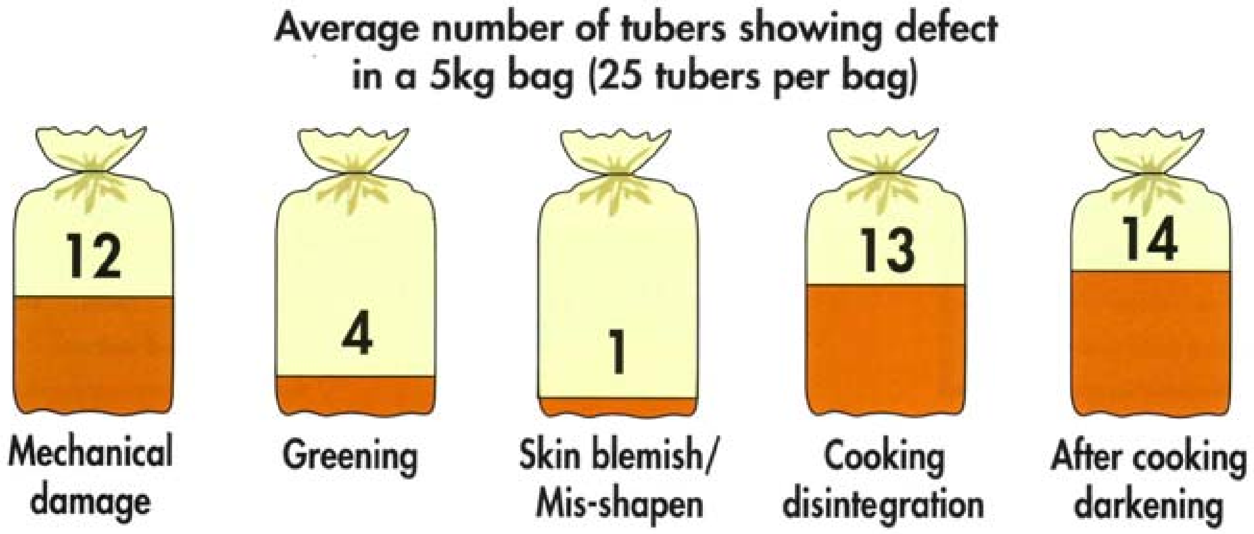
- potatoes are very popular, value for money and are found in 99.7% of homes
- the frequency of potato consumption per week is declining and being replaced by rice and pasta, especially in the under 40 age group

This consumption trend has long-term implications for the consumption of potatoes.

Most industries would give their eye teeth for the level of market acceptance and penetration which potatoes have and yet the potato industry is complacent when compared with its competitors.

The rice and pasta industries intensively market and promote their products. They also pay great attention to quality during the production phase.

On the other hand, potato quality is a problem, with 20% of consumers dissatisfied with quality, and 50% occasionally annoyed about poor quality.



In 1995, a study of the marketing chain by Andrew Henderson and his team from Agriculture Victoria, identified that 49% (by weight) of retail potatoes on offer to consumers were mechanically damaged (cut or bruised) in some way.

In addition:

- 16% show greening
- 76% of samples show after cooking darkening
- 84% show some boiling disintegration

This means that in a 5 kg bag containing 25 tubers:

- 12 will show mechanical damage
- 4 will be green
- 14 will show after darkening cooking
- 13 show boiling disintegration
- 1 will be mis-shapen or have skin blemishes

"Consumers have had bad experiences with the quality and have poor perceptions of fresh potatoes."

Where does mechanical damage occur

By examining the damage along the market chain from paddock to retailer, it is clear that damage occurs equally on the farm and post farm gate.

Andrew's study showed:

- 14% damage on-farm from digging and handling
- 16% increase in damage post farm gate, (ie during grading, packing, transport, storage)

Consumer research shows that visual defects are a strong deterrent to purchasers. Therefore the damage problem should be a major concern for all sectors of the production marketing chain from growers to retailers .

"The problem of poor potato quality is shared equally along the chain."

Consumers' habits

Market research was commissioned by Agriculture Victoria to identify what consumers really want.

The initial research found the following:

- consumers tend to replenish stocks working on a "just in time" basis
- consumers do not search extensively when purchasing potatoes
- firmness is a major factor in choice
- keeping quality, self-selection, washed, medium size, white skins etc. are also important factors in consumer choice

This preliminary research calls into question the practice of a number of retailers of offering and selling "painted potatoes" (washed potatoes which are then dusted with red sand).

"This research on damage, marketing practice and consumer habits highlights the need for the fresh potato industry to focus more on customers and their definition of quality."

Financial performance

Financial performance was analysed for potato farms across traditional potato growing areas of Victoria.

Net return per tonne was used as the key financial performance indicator to class the 35 farms into: 'high,' 'medium' and 'low' net return groups.

The three groups had the following average net returns:

low: $ - 76/t

medium: $32/t

high: $131/t

This shows that there is considerable variation in financial performance based on net return per tonne, between the high and low performing potato farms.

Net return is driven by price, variable cost/tonne, overhead cost/tonne, yield and area grown. If we examine the differences in these figures for the low and high net return groups some interesting comparisons emerge.

Price received-:	27% higher for high group
Variable cost/tonne:	7% lower for high group
Overhead cost/tonne:	56% lower for high group
Yield:	19% higher for high group
Area grown:	135% greater for high group

The lessons from this emphasise the need for growers to focus on increasing yield, marketing to obtain good prices (which is linked to the product quality) and increasing efficiency in the use of equipment and labour to reduce overheads costs.

A reduction in overhead costs, while increasing efficiency of equipment use is critical. For example, in Tasmania a study identified that in a district which had 95 potato harvesters, the total crop could be harvested with between 25 and 30 harvesters.

We need to think about what is the capacity of machinery in terms of what it can do in 365 days working 24 hours a day.

To be internationally competitive, we need to get away from the mentality of ....."I want to own and do everything myself".

The markets are dictating that we must utilise all our resources more efficiently to reduce cost and improve quality. This change in thinking will be a major challenge which the industry must address.

Independence and working as individuals, needs to be replaced with interdependence, working with people and organisations which can compliment what we do and which benefits all parties.

The industry needs to develop a "win, win, win" culture and get away from the short-sighted "them and us" syndrome which has existed in the industry for too long.

"A focus on efficiency, customers and quality requires strategic alliances, strong relationships and partnerships."

Where to from here

The potato industry is truly at the cross-roads. It can choose to undertake massive expansion and become a threat to other potato producing countries, or it can do nothing and continue the decline, thereby allowing Australia to become a target market for other countries.

To become internationally competitive on cost and quality, and capture the emerging opportunities, the industry must:

- focus on supplying consistent, reliable quality produce, as defined by customers through detailed market research
- develop a "best management practice" approach to the production and supply, which is driven by consumers, to improve quality and efficiency
- work with major retailers and processors to improve quality and efficiency and to expand the industry and markets to capture the export potential
- adjust and rationalise production and processing capacity and improve efficiency
- focus on food safety and sustainable production practices, with particular emphasis on efficient water use and improvement of water quality

While the industry may be at the cross-roads, there are massive opportunities for the industry to capture, if it can make the changes necessary and do things differently to the way they have been done in the past.

"A definition of insanity is..... doing the same things while expecting different results."

■

Industry to test new varieties

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During the 1997-98 season, several new potato varieties will be tested in large commercial plantings in collaboration with potato processors, potato packers and merchants.

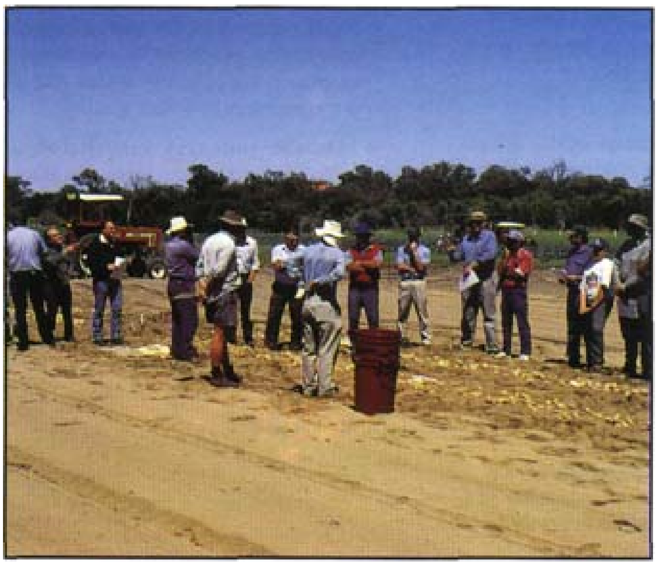
These new varieties have performed better than commercial varieties in trials on growers properties over the last three years.

The new fresh market varieties *Ruby Lou, Shine, Winter Gem* and *Mondial* will be grown and tested in commercial plantings in various production districts.

The crisp processing variety, *Crispa,* will be tested in collaboration with the Smiths Snackfood Company and Frito Lay whilst the French fry processing varieties *MacRusset, 89-12-1* and *Donnelly Russet* will be tested in collaboration with McCain and Simplot.

Australia's only potato breeding program, based at Toolangi, Victoria, breeds and selects new varieties in trials and then supplies seed of the best lines for testing on commercial properties in potato growing areas across Australia. Varieties are also imported from overseas and tested.

Western Australian potato industry members at a demonstration of new freshmarket varieties near Perth



Merv Mullens certified potato grower at Thorpdale, Victoria with nuclear seed of the new variety *Ruby Lou*

Varieties developed to date by this program include *Coliban, Snow Gem, Winlock* and *Wilstore,* bred in Australia, and *Atlantic, Shepody* and *Nadine,* imported from overseas.

The promising new varieties selected by the program are described below.

Fresh Market Varieties

Ruby Lou

(previously known as 90-40-7) Vic, SA, NSW, Qld, WA

Ruby Lou has performed well in trials across many production sites in Australia.

Tubers have a light red skin colour which is slightly darker than *Desiree* but does not fade when grown into winter or after plant senescence like *Pontiac.*

The skin of *Ruby Lou* is smooth and retains sheen or bloom after washing. In damage tests, it resists skin scuffing and tuber shatter crack. This variety has good boiling quality with excellent flavour and has light colour after frying.

Ruby Lou has short tuber dormancy, similar to *Sebago,* fast plant growth and early tuber bulking, making this variety suitable for the dual cropping/kept-seed areas of the Riverina, Riverland, Swan Coastal Plain and Lockyer Valley.

Harvested in winter grown from seed harvested in early summer: average of 2 trials 95-96

	Ruby Lou	Desiree
Yield No. 1 grade (80g - 450g)	30.5 t/ha	23.1 t/ha
Tubers per plant	6.6	6.4

Harvested in winter grown from seed harvested in early summer: average of 5 trials 94-95 and 95-96

	Ruby Lou	Pontiac
Yield No. 1 grade (80g - 450g)	38.6 t/ha	38.3 t/ha
Tubers per plant	5.3	5.7

Harvested in autumn grown from coolstored seed: average of 6 trials 94-95 and 95-96

	Ruby Lou	Pontiac
Yield No. 1 grade (80g - 450g)	56.8 t/ha	50.6 t/ha
Tubers per plant	8.1	5.8

Harvesting potato varieties at Forthside Vegetable Research Station, Tasmania

Shine

(previously known as 90-105-14) Vic, NSW, SA, Qld

Shine has bright white skins which are usually smooth with very small lenticels, similar to *Coliban.* Tubers have short dormancy, similar to *Sebago,* and early maturity and tuber bulking similar to *Pontiac,* making *Shine* suited for the dual cropping/kept-seed areas such as the Riverina, Riverland and Lockyer Valley.

Shine is resistant to Potato Cyst Nematode (strain Rol).

Trials harvested in Winter grown from seed harvested in early Summer: average of 4 trials 1995/96

	Shine	Coliban
Yield No. 1 grade (80g - 450g)	35.1 t/ha	16.0 t/ha
Tubers per plant	6.7	4.8

Trials harvested in autumn from coolstored seed: average of 6 trials 1995/96

	Shine	Coliban
Yield No. 1 grade (80g - 450g)	50.9 t/ha	50.6 t/ha
Tubers per plant	8.4	5.2

Winter Gem

(previously known as 90-105-16) WA

Winter Gem produces good yields of round, smooth skinned, white fleshed tubers. It has performed well in all seasons in Western Australia. Its best performance has been in winter where the formidable combination of powdery scab resistance and tolerance to storm damage gives *Winter Gem* a high chance of being adopted by industry.

Powdery scab tolerance: average of 2 trials 1995/96

	Winter Gem	Delaware
Tubers free from scab (%)	97	59
Scab index (the lower the better)	1.0	3.5

Skin quality is excellent for washing but careful handling will be required to ensure skin quality is maintained through the marketing chain. If this is done *Winter Gem* tubers will stay shiny until well after purchased by the end user.

The consumer will also find *Winter Gem* very acceptable as it has good culinary quality. The latest quality tests done by the Potato Marketing Corporation of Western Australia show that *Winter Gem* has good taste, good to excellent mashing quality, it is good for microwaving and it produces acceptable French fries for domestic consumption.

Average of 2 trials planted April/May 1995/96

	Winter Gem	Delaware
Yield Grade No.1	30.3 t/ha	27.3 t/ha
Tubers per plant	6.3	5.6

Mondial

WA

Mondial is a Dutch variety. It produces high yields of large, oblong tubers with pale yellow skin and flesh. *Mondial* is resistant to Potato Cyst Nematode (Rol).

Mondial has potential as a replacement for *Spunta* in Western Australia, but with an extended production window.

In winter it produces higher yields and larger tubers than *Delaware* but a more even sample than *Spunta. Mondial* has potential for summer production unlike *Spunta* which suffers from soft rot.

In summer *Mondial* produces high yields of more attractive tubers than *Delaware. Mondial* is also suited to dual cropping systems.

When treated like *Delaware, Mondial* is prone to produce over size tubers so growers must either reduce fertiliser, plant *Mondial* closer or spray crops off earlier.

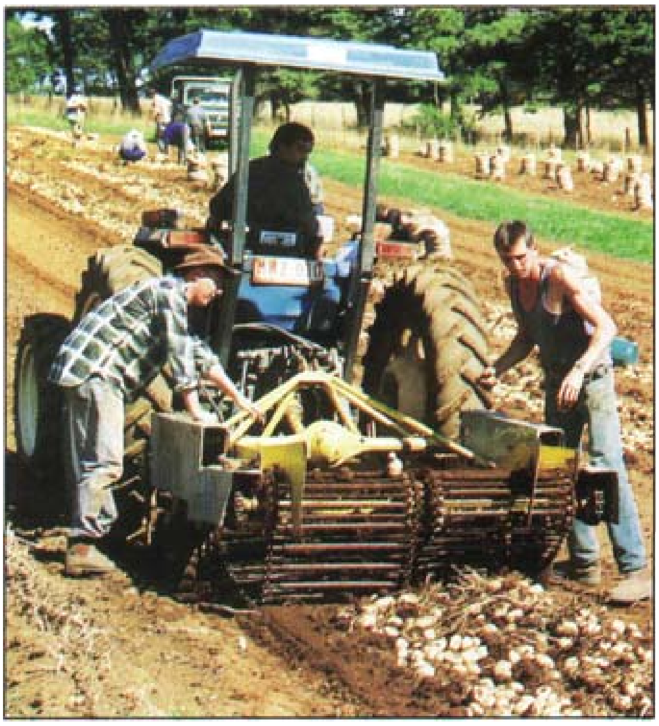
Mondial is good for salads and for microwaving and is acceptable for mashing. It is not recommended for frying as colour is dark and French fries are soggy.

Mondial and *Winter Gem* are being tested commercially in WA in conjunction with the Potato Marketing Corporation of Western Australia.

Average of trials according to planting time 1992-96

Planting Time	Yield	Mondial	Delaware	Spunta
Spring	**Grade No.1** (80-450g)	46.8 t/ha	34.7 t/ha	45.2 t/ha
	Tubers per plant	8.5	6.6	6.9
Autumn	**Grade No.1** (80-450g)	27.1	11.8	42.2
	Tubers per plant	4.5	4.7	4.8

Digging potato seed atToolangi. This seed is the basis for variety trials in production areas across Australia.



Crisping Varieties

Crispa

(previously known as *90-7-17)* Vic, SA, NSW, Qld

Crispa produces a very large number of tubers per plant, usually twice as many as *Atlantic*, giving this variety the potential for very high yields of small to medium sized tubers preferred by crisp processors.

Crisp colour is light at harvest and after long term storage at 10°C. Crisp colour is also light after storage at 4°C if tubers are reconditioned before processing.

Crispa tubers are evenly sized and have round slightly flattened shape. Tubers have heavily netted skin. In repeatable bruise tests, it is more resistant to damage than *Atlantic*. Plants are later maturing than *Atlantic* and tubers bulk late during plant growth.

Average of 5 trials at Koroit, Koo Wee Rup and Toolangi in 95-96 and 96-97

	Atlantic	Crispa
Crisp colour: (scored 1-10, 6 is borderline, >6 is too dark)	3.7	3.7
Dry matter (%)	20.8	21.3
Specific gravity: (min. SG is 1.070, bonus paid for 1.075 to 1.090)	(1.083)	(1.085)
Yield:		
Crisp grade: (50g - 430 g or 45mm - 95mm)	47.7 t/ha	46.6 t/ha
Preferred grade: (80g - 300g or 65mm - 85mm)	37.6 t/ha	38.1 t/ha

French Fry Varieties

MacRusset

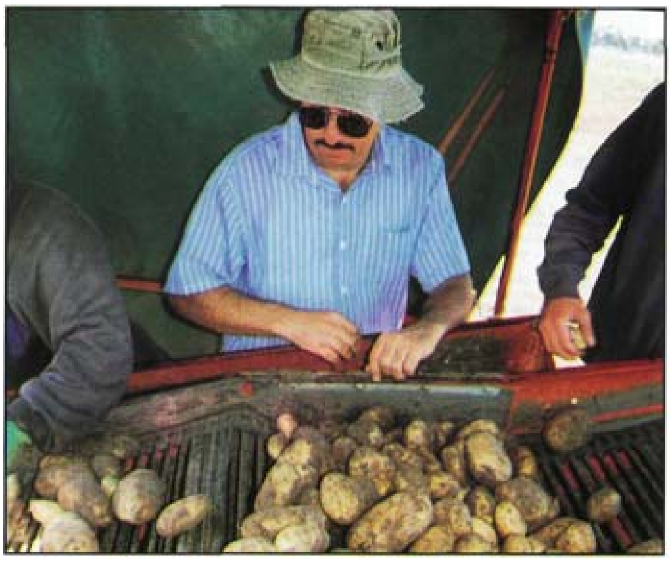
(previously known as *89-27-33)* Vic, SA,Tas

MacRusset tubers are long and evenly shaped. Fry colour is light and even along the length of chip at harvest and after mid term storage. *MacRusset* does not have internal defects and hollow tubers or brown centres are rarely seen.

Plants have a long growing period, slightly later than *Russet Burbank,* and tubers bulk late during plant growth.

Dry matter content of *MacRusset* is slightly higher than *Russet Burbank* and it is more resistant to shatter damage. *MacRusset* is far less prone to secondary growth and production of misshapen tubers compared to *Russet Burbank.*

Chris Williams at the harvest of MacRusset at Andrew Widdison's farm, Kalangadoo, South Australia



Plants produce many tubers and *MacRusset* should be planted at spacings 2.5cm (1 inch) closer than *Russet Burbank.*

Average of 12 trials 1995-96

	Mac-Russet	Russet Burbank
Yield - fry grade: (100g and over)	71.4 t/ha	60.1 t/ha
Dry matter (Specific gravity): (minimum SG is 1.066)	21.4(1.086)	20.9(1.084)
Fry colour: (Scored 1-10, 7 is borderline, >7 is too dark)	6.7	6.3
Secondary growth/internal defects: (knobby tubers, hollow or brown centres)	very low	very high

89-12-1

Vic, SA, NSW

Tubers of *89-12-1* are oblong shaped with smooth white skin. When grown in sandy soils, tubers have long shape. Dry matter is slightly higher than *Russet Burbank* and fry colour is light at harvest and after long term storage at 10°C. *89-12-1* has a very low level of internal defects and hollow tubers or brown centres are rarely seen. *89-12-1* is resistant to Potato Cyst Nematode (strain Rol).

Average of 9 trials 1995-96 and 1994-95

	89-12-1	Russet Burbank
Fry grade: (100g and o**ver)**	59.0 t/ha	53.2 t/ha
Dry matter (Specific gravity): (minimum SG is 1.066)	20.8(1.083)	20.9(1.084)
Fry colour: (Scored 1-10, 7 is borderline, >7 is too dark)	5.4	6.4

88-31-5 (Donnelly Russet)

WA

Donnelly Russet is undergoing commercial tests with Simplot Australia in Western Australia. It produces very large, long-oblong tubers with light fry colour and high dry matter. It must be planted closer than *Russet Burbank.* Most experiments have shown that *Donnelly Russet* is much less prone to internal disorders than *Russet Burbank.* It has slightly longer maturity than *Russet Burbank* and appears to be resistant to Alternaria blight (target spot).

Donnelly Russet also has potential for processing after storage. It has long dormancy and tubers remain firm.

Average of 5 trials planted October/November in WA

	Donnelly Russet	Russet Burbank
Marketable Yield (tubers more than 100g)	52.6 t/ha	45.8 t/ha
Dry Matter	20.2	4.7
Fry colour (Scored 1-10 where 7 is borderline for French fries, > 7 is too dark)	19.7	19.7

Acknowledgements We would like to thank the growers, processors and potato packers who have helped with variety testing and we gratefully acknowledge the HRDC.

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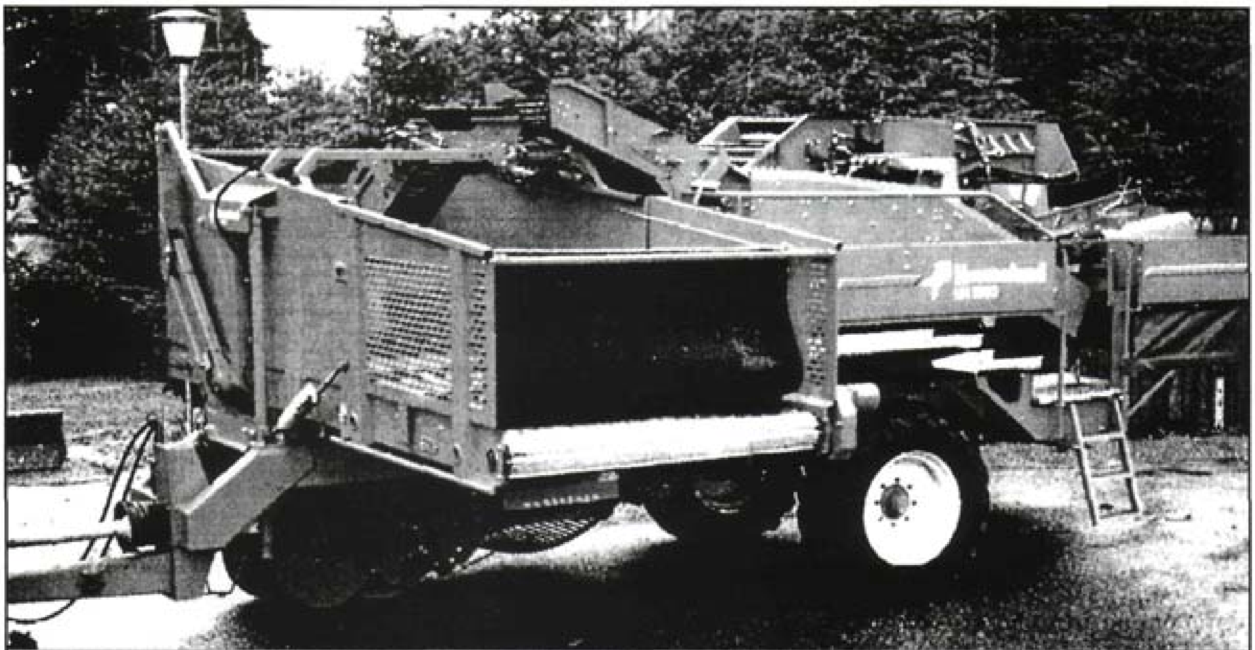

Drip irrigation on potatoes - the way of the future

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A great result was obtained in a trial using drip irrigation on potatoes last summer.

A commercially harvested yield of 54.7 t/ha resulted from the first successful drip system trial on potatoes in Victoria. This was 5.2 t/ha higher than the district average for 1996-97.

The extra yield more than covers the extra $650 per ha cost of the system compared to travelling gun irrigators - costed on a commercial scale.

The trial was done on the Ballarat Demonstration Farm at Bullarook (east Ballarat) in a crop of *Russet Burbank* potatoes destined for French fry processing.

An area of 0.4 ha was set up during early summer using drip tape technology and automatic controls. The drip tape was placed on top of each row of potatoes and the area watered almost every day depending on the weather. Small quantities of fertilisers were dissolved and irrigated through the drip tape to adjust nutrition in the trial area.

The drip irrigation system was started on January 7, 1997 (crop planted on November 18, 1996) and the potatoes were killed by frost on April 17 even though the leaves were still quite green over most of the area.

Drip tape in action at the base of a potato plant.

Difficulties experienced

Problems encountered with the trial include:

- the trial was set up late due to some vital parts to the system not being available when required. Plant growth was restricted before the drip system was installed
- filter blockages occurred twice
- electrical faults occurred several times due to power grid failure (pump and automation was electrically powered)
- crop nutrition required adjustments which were not able to be made on time due to slow results from the testing laboratory used
- rats invaded the area and chewed into the drip tape but only later in the season. They also had a significant impact on the potatoes they were feeding on. The trial was situated next to bush which was ideal for harbouring rats

Despite the above set backs to the crop, the resulting yield proved that drip technology has great potential in potatoes, as has been found in other horticultural crops, such as tomatoes and fruit trees.

Management requirements

A drip system requires close attention to monitoring both soil moisture and nutrient status.

The soil in our trial was free draining resulting in the water moving quickly down through the soil in a narrow band and not moving very far sideways in the mould. This meant the crop needed to be irrigated every day. However this was not detrimental to any aspect of the crop's growth.

A moisture monitoring system is vital to get the best out of the system. If overwatering occurs, nutrients may be washed from the root zone of the plants; underwatering reduces yield potential. In our trial we used new age tensiometers (tubes with rubber bungs and meter with hyperdermic needle) to monitor soil moisture levels in the crop.

The nutrient status of the crop needs to be monitored often so that rapid adjustments can be made to feeding the plants - a drip system can be a nutrient management system as well as an irrigation system.

A drip irrigation system requires relatively flat land to ensure even watering. Slopes of up to 3% slope (ie 3m fall in the slope of the land over 100m length) are considered suitable, but with good system design, slopes of up to 6% may be tolerated.

Benefits of drip irrigation

Our trial has shown that drip irrigation may be a viable irrigation alternative on flat land. Some of the benefits of a drip system include:

- allows frequent and timely irrigation which can maximise growth
- the leaves on the crop are not made wet when irrigating which reduces the extent of leaf diseases like Irish blight and target spot in potatoes. This in turn reduces the need to use chemicals to control these diseases
- using an injector system, dissolved nutrients can be applied quickly and uniformly to the crop
- surface soil structure is not destroyed as in high impact irrigation systems such as travelling gun type irrigators and some lateral move systems
- operating at 60% of the pressure of a lateral move irrigator, the low pressure drip irrigation system offers power savings in proportion to the lower operating pressure of the drip system (up to 120 kPa pressure or 17 psi).

labour time savings during the season are made by the use of automation of the drip irrigation system.

can be used in small and large scale operations from as small as wanted to over 200 ha as is the case with some tomato growers in northern Victoria.

Further work is proposed next season according to the level of interest and support that is received on using this technology.

Acknowledgements
This work was supported by the QC Potato Project (Agriculture Victoria), HardieToro Irrigation and Rural &Turf Irrigation. ■

Discussions about the drip system at the 1997 Ballarat Demonstration Farm field day

Merchandising program helps educate consumers

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Consumers are keen to learn more about the selection, storage and cooking of potatoes. This provides excellent opportunities for promotion.

Effective promotion of potatoes with little finance seemed a daunting task for the Potato Growers of South Australia (PGSA) until their promotion committee came up with the solution of funding a pilot project through one of the Department of Employment, Education and Training employment programs.

What started as a low risk pilot project has opened the door to a much larger project funded by PGSA.

Buy Fresh Promotions, the promotional department of the Adelaide Produce Market, was approached to run the *New Work Opportunities Potato Training Project* which commenced in October 1996. The pilot program involved four long term unemployed trainees, six weeks training at the Adelaide Produce Markets and 20 weeks of work experience in store.

The trainees discovered that consumers and retailers had a lack of information about potatoes such as the different varieties and how they should be stored and handled. They also found that consumers and retailers were genuinely interested to learn more about potatoes.

This lead the PGSA to realise the benefits of conducting a similar program involving more people in more areas of Adelaide and the PGSA *Potato Merchandising Program* was developed. This was a big step for the PGSA whose members had not been involved in this sort of promotional activity before.

The *Potato Merchandising Program* involved a team of 13 *Buy Fresh Promotions* trained Consumer Educators who targeted 180 stores throughout metropolitan Adelaide over six months, to provide information and advice on all aspects of handling and cooking potatoes.

Buy Fresh Promotions' **team of Consumer Educators**

Consumer Educator, Anne Kelly providing information to a customer

The program was divided into two separate components; retailer liaison and customer education. About 90 hours were spent in store liaising with retailers and 360 hours educating customers.

The Consumer Educators were trained in all facets of the industry, including a field visit to a potato grower and packer, and were well prepared to answer the questions consumers might ask.

The Consumer Educators talked to retailers about stock rotation, potato varieties and greening. They also provided point of sale material which included price and descriptive cards for the different potato varieties.

The discussions with the retailers revealed useful information about how often the potatoes were purchased from the market, when they were bagged in the store, the quality of the potatoes and the lighting situation in stores.

In the fresh fruit and vegetable sections of the stores the Consumer Educators approached customers offering them recipe leaflets for the different potato varieties, talking to them about the best cooking methods, and providing information on the correct selection of varieties for a particular use and storage techniques.

Many questions were asked by customers but the most common ones were "why do they sprout?" and "what makes them cook black?"

Customers have generally been very positive towards the promotional campaign and pleased to receive the information brochures and recipes.

The *Potato Merchandising Program* finished in June and did a great deal towards educating retailers and consumers. It targeted a diverse cross section of the population focusing on both independent and chain supermarket outlets. ■

National QA project is underway

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After years of careful planning and market research, a project aimed at developing a quality assured production and marketing system for fresh potatoes is under way!

The project was developed jointly between the Queensland Department of Primary Industries and Queensland Fruit and Vegetable Growers in response to a number of recent market studies which highlighted areas for improvement if the fresh potato is to compete successfully.

Most alarmingly, the Potato Market Research report (1994), commissioned by HRDC, found that 20% of consumers were not happy with the quality of the potatoes they purchased and 50% were occasionally annoyed by the quality of fresh potatoes. This report also predicted that consumption per person is likely to fall from 35 kgs per person to 28 kgs by 2023.

With increasing competition from other food products and a high level of dissatisfaction with the quality of the product currently being presented to the market, the future of the fresh potato is under threat.

Improving grower access to quality assurance

This project has been developed to apply the principles of quality assurance (QA) to fresh potato production and improve consistency of product from the national crop (one of the problems identified by the Lewis report).

The project is focused on growers and giving them easier access to QA in a form that can be applied to fresh potato production. They will then be in a better position to produce a product to the level of quality assurance today's consumers require.

National pilot

The project is based around the participation of a group of enthusiastic potato producers from the Lockyer Valley who have given up a large amount of time and made a commitment to market a percentage of their produce through a set market chain that in some cases may be different to their current marketing arrangements. This will allow the principles of quality assurance to be applied in an everyday marketing chain, which can be closely monitored giving instant feedback to the producers.

A major retailer, Woolworths Queensland and a Queensland based merchant, Bairds Produce have also volunteered to participate to form the remainder of the marketing chain. Woolworths and Bairds are currently undertaking QA programs themselves thus providing complete QA coverage from the farm to the consumer.

The project commenced in late 1996 and is well on the way. The following is a brief summary of what has happened so far:

Errol Peiper (centre) and sons Craig (left) and Stewart (right)
The Peipers are involved in the pilot project and have implemented crop records and set up a property map for this crop

- a pilot group of growers has been formed and members are developing property maps to aid in product traceability, crop treatment records to verify traceability and prove what they are doing
- a complete marketing chain has been established all the way to the consumer where every participant is involved in the implementation of QA with an emphasis on food safety
- food safety requirements to meet current retailer demands have been established
- HACCP (Hazard Analysis Critical Control Points) plans for potato production are currently being developed
- the first market trial to evaluate product when it reaches the consumer has been completed
- growers have visited and talked to the marketers and consumers to gain a better understanding of what is required
- growers have attended a number of training sessions covering the principles of QA, food safety and group dynamics
- contact has been established with a range of growers, packers, industry organisations, wholesalers and retailers who are involved in or interested in the implementation of QA and food safety systems

Food safety and potato farming

The key aspect of all QA systems that is emerging is the need for a food safety system such as HACCP. The pilot group is endeavouring to adapt HACCP to potato production simply, efficiently and effectively. This will then provide a model for other growers to work from.

The project has already highlighted a need for the potato industry to get going on QA, and in particular, food safety. The ability to be able to prove what you are doing is being increasingly demanded by retailers who are wary of the potential damages they could incur from litigation as a result of poor levels of food safety.

The application of QA and food safety systems to fresh potato production is very new to the industry and presents a number of new challenges to growers.

Commonly asked questions

Some of the common questions asked by growers are, What is QA? What do I have to do to apply it? What will it cost? What will I get out of it and where do I start?

The pilot group of growers involved in the project are in the process of sorting out the answers to these and many other questions relating to QA.

Where do we start

To get started growers need to ascertain what is required by the market they intend to supply. In most cases, adoption of the HACCP food safety system is a good starting point.

Records of chemical applications are a must and need to show what was done, how much was used, when it was done and who did it. Some sort of paddock identification may also be needed to prove where the application has taken place and where the produce was grown.

Remember, keep it simple!

Keep your eyes on the new publication Eyes on Potatoes for updates and down to earth information about QA. Eric can provide contact details if anyone wants to talk to group members directly to obtain practical tips on how to get started.

Acknowledgements
This project has been funded by the HRDC. The Potato Market Research report is available from HRDC at a cost of $20 (Quote Project PT201).

■

Assessing the biofumigation potential of brassicas

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John Matthiessen in test plots of brassicas grown to assess biofumigation potential.

Biofumigation refers to the use of plants with toxic properties in rotations to suppress soil-borne pests and diseases.

Biofumigation offers the potential to control potato pests and diseases such as whitefringed weevil, nematodes, *Rhizoctonia* and *Fusarium* without the need to apply chemicals such as metham sodium.

Although in a research phase, results indicate that such pests may be able to be controlled by using particular brassica crops in the potato rotation. These brassicas may be harvested, used for fodder or ploughed in as a green manure.

Recent research has focused on measuring the potential of various types of brassicas for biofumigation.

Many of the plants in the brassica family such as rapeseed and mustard produce chemicals called glucosinolates that break down into toxic isothiocyanates. These are similar to and sometimes better than the type of isothiocyanate produced by the chemical fumigant metham sodium.

Scientists are investigating whether such plants can be used as natural fumigants to assist in the control of soil-borne pests and diseases.

Brassicas differ in their toxicity

In the laboratory the vapours released from brassica plants can be very effective in controlling diseases and insects. The effect varies depending on the brassica and which part of the plant is used.

When white fringed weevil larvae, a soil insect pest of potatoes, was exposed to vapours from seed meal of canola and Indian mustard the effects were vastly different.

The mustard meal emitted highly toxic vapours from very small quantities whereas the canola meal was harmless, even in very large doses. Similar effects have been recorded against diseases such as *Rhizoctonia* and *Fusarium* and pests such as nematodes.

It is these toxic effects that have encouraged scientists to investigate the use of brassicas as green manures to help control pests and diseases in horticulture.

Finding the right brassica

Many brassicas have been selected to have low amounts of glucosinolates to make them more useful as oilseed or fodder plants. The most notable amongst these is the development of canola for the production of edible oil from its seeds.

In a similar way, a number of leafy forms have been selected as fodder rapes, because reduced glucosinolates in the leaves increases palatability to livestock.

Using the same plant breeding principles, it would be possible to select types that have much higher levels of glucosinolates to use them specifically as biofumigants.

As part of the biofumigation research project a major effort is being put into chemically analysing a large collection of brassicas grown in the field and glasshouse at CSIRO in Canberra to determine which have the best characteristics for use as biofumigants.

Over 80 brassicas from 14 species, sown in autumn and in spring, have been analysed. There was a large variation in the type and concentration of glucosinolates found in the shoots and roots. The glasshouse tests indicated that plants grown under warmer conditions have higher glucosinolate levels.

It was interesting to note that the presence of high concentrations of glucosinolates in one part of the plant did not necessarily mean a high concentration in other parts of the plant. It is therefore theoretically possible to have a brassica with palatable seeds and biofumigant shoots and roots.

In conjunction with the plants grown for chemical and growth analysis at Canberra, small plots of several different brassicas were grown in two potato-growing areas in Western Australia - Busselton (mild coastal conditions) and Manjimup (inland area with colder winters). Information about the growth of the plants was collected to assist in determining their biofumigation potential in different environments.

Biofumigation potential

The different growing conditions at the three sites produced different sized plants, with the warmer sites in Western Australia producing much larger plants. No irrigation was applied.

The differences in growth at various locations dramatically altered the potential quantity of glucosinolates produced. There were also differences in growth and glucosinolate concentration between autumn and spring sowings.

A very encouraging aspect of brassicas is that there is no evidence that the glucosinolate concentration becomes diluted as plants grow larger. It appears possible then, to have brassicas that produce both large plants and high concentration, resulting in a large glucosinolate total.

To determine the biofumigation potential of the various brassicas the production of toxic substances was estimated assuming uniform incorporation of plant material into the soil and complete release of toxic substances.

To put these estimates in perspective they were compared to the amount of toxin that would be added to the soil if 500 1/ha of metham sodium was applied. Some of the brassicas had the potential to put up to two or three times the amount of isothiocyanate into the soil per hectare as metham sodium.

It must be emphasised that the results are an estimate of the potential for a biofumigation effect. It is also important to note that the estimates do not take account of the differences in the type and level of the toxic substances produced.

This aspect appears to be extremely important and is a major focus for future research. Further work is also planned to determine the toxicity of different brassicas and their actual effects on pests and diseases.

Of the eleven species grown in all three locations eight were fodder rapes, kales or swedes, one was a white mustard, one an Indian mustard and one a canola. The white mustard produced the greatest total amount of glucosinolates per hectare, followed by two fodder rapes. All three grew vigorously, the high total reflecting moderate to high glucosinolate concentration and large bulk.

Conclusions

The results suggest that there is substantial potential to enhance biofumigation by selecting brassicas adapted to different climatic areas. If this approach proves to be a viable option for growers there will be opportunities for breeders to develop specific types for biofumigation, just as has been done for oilseed and fodder types.

To foster interest and understanding of the biofumigation research for different applications and production systems a *Biofumigation Update'* newsletter is produced and circulated widely to growers, consultants, advisers and researchers. If you would like to be on the mailing list, please contact John Matthiessen.

Acknowledgements This research is supported by the HRDC and the Grains Research and Development Corporation.

HRDC

■

Round or cut seed - the answer is usually not cut and dried

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Trials have been conducted throughout Queensland to see if returns are improved by using round seed rather than cut seed.

Perceived advantages of the use of round seed include:

- improved and more even emergence
- less seed piece diseases
- more uniformity in tuber size
- greater returns (resulting from a combination of the above)

Our observations from evaluating several varieties at various plant spacings generally confirmed these perceptions.

Round seed produced more stems per plant, greater emergence, higher yields in the 80-350g size range, a more impressive top growth and usually higher yields.

However when the extra cost of round seed was taken into account, the extra yield did not always translate into improved returns (see district graphs).

To determine the returns the specified grade yield was multiplied by an arbitrary price of $300.00 per tonne and the cost of seed subtracted. This was done on a per hectare basis.

What we found

Southern Queensland

In southern Queensland there was generally an advantage in using round seed in preference to cut seed after taking into account the extra cost of the round seed (inherent cost + extra quantity of seed required) and the associated freight component.

We determined that southern Queensland growers would need to produce an extra 5.7, 4.7, 3.6, and 2.8 t/ha for 20, 25, 32.5 and 40 cm spacings respectively from round seed to cover the extra cost of this seed including freight to break-even with the use of cut seed.

North Queensland

To break even from using round seed in North Queensland, the corresponding yield increases would need to be slightly more than those needed in southern Queensland, to compensate for the extra freight component.

Spacing

When there was an economic advantage shown for cut seed over round seed, it was usually at the closest spacing within the row. This is probably because of the extra seed costs involved when planting round seed at these plant densities compared to the extra yield advantage obtained.

Age of seed a major factor

The seed planted in the district trials was supplied by a group of cooperating Victorian seed growers and varied in physiological age. This we believe is a major factor influencing the inconsistency in the results.

We believe that round seed may need to be past the stage of apical dominance to produce best results. If round seed is planted when only the first apical shoot is present, it may perform very similiarly to cut seed. Because of the earliness of the North Queensland production, the round seed may not have been aged sufficiently to realise its full potential.

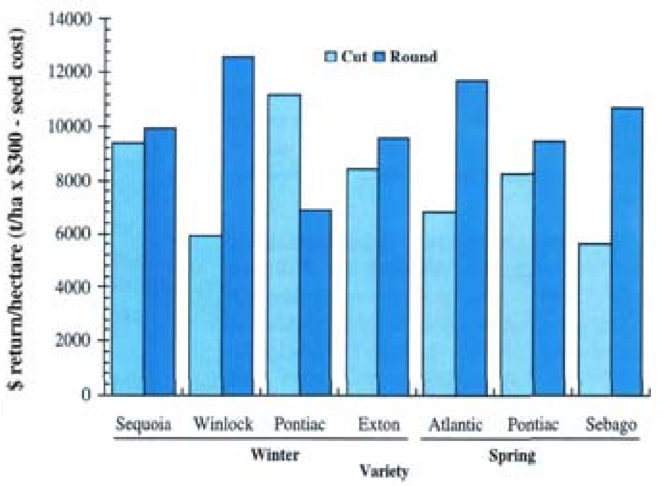
The effect of physiological age is currently being investigated by evaluating round and cut seed after different harvest dates of certified seed and subsequent storage treatments prior to planting in Queensland.

District results

Gatton Research Station - Lockyer Valley

The advantage of round seed was more pronounced in the spring planting.

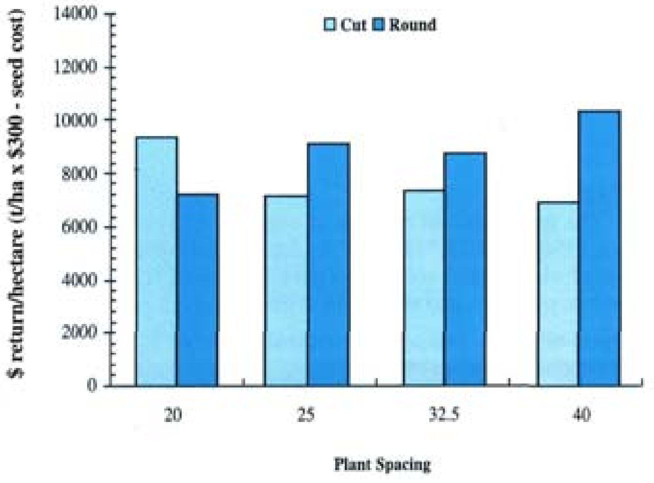
In the winter planting, there was a distinct advantage of using cut seed for *Pontiac* but little difference between either seed form for *Sequoia.*



Comparative returns from the use of cut and round seed of various varieties when planted at 25cm spacings in 75cm wide rows. Returns for tubers in the 80-350g grade size are presented.

Redland Bay • SE Queensland

At this site, round seed out-performed the cut seed (except at the 20 cm spacing), for each of the varieties *Sequoia* (see graph), *Pontiac* and *Exton.*

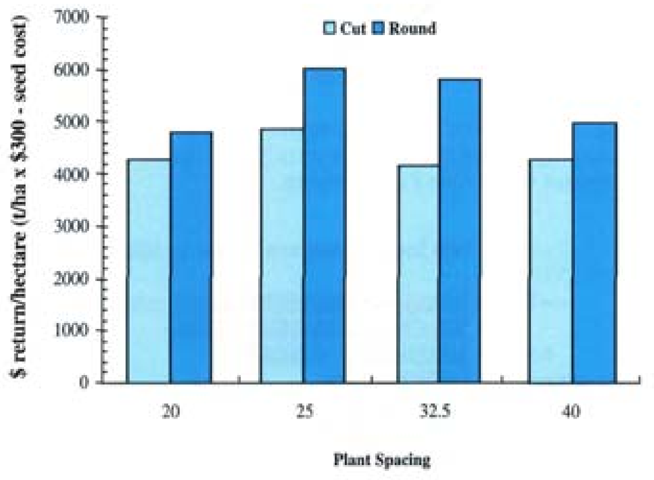


Comparative returns from cut and round seed of *Sequoia* grown at Redland Bay at various spacings in 75cm wide rows. Returns for tubers in the 80-350g size range are presented.

Grantham - Lockyer Valley

For *Atlantic* (see graph) there was an advantage in using round seed at all four spacings.

For *Trent* and *Sebago* (not shown) there was no advantage of round seed over cut seed at any of the four spacings.

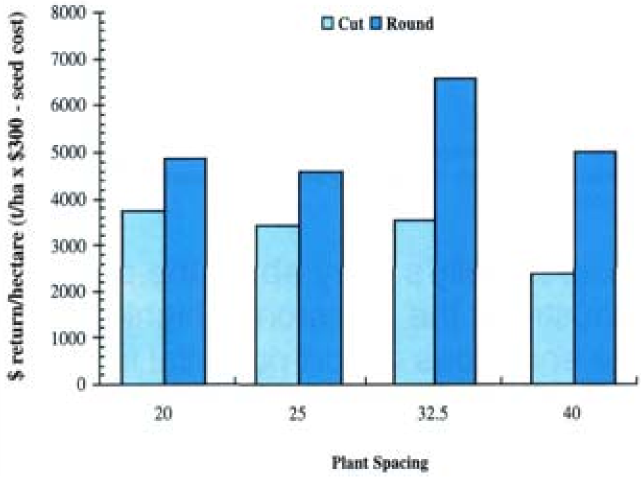


Comparative returns from cut and round seed of *Atlantic* grown at Grantham at various spacings in 75cm wide rows. Returns for tubers in the 80-350g size range are presented.

Gatton - Lockyer Valley

Overall there was an advantage by using round seed particularly in *Pontiac* (see graph).

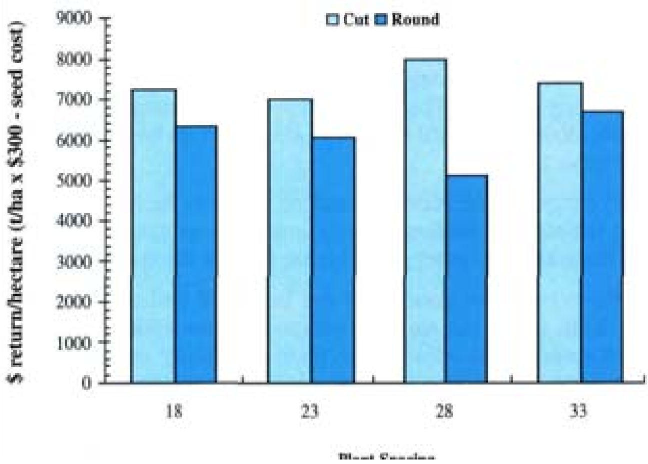
This was not so pronounced in *Sebago* and even less in *Red la Soda* (not shown) where there was little difference between the two seed types.



Comparative returns from cut and round seed of *Pontiac* grown at Gatton at various spacings in 75cm wide rows. Returns for tubers in the 80-350g size range are presented.

Kairi - Atherton Tablelands

At this site the intra row spacings were closer than in Southern Queensland. Here there was a definite general advantage of cut seed over round seed in each of the varieties *Pontiac*, *Atlantic* and *Sebago* as clearly illustrated for *Atlantic.*



Comparative returns from cut and round seed of *Atlantic* grown at Kairi at various spacings in 75cm wide rows. Returns for tubers in the 80-350g size range are presented.

Acknowledgements

The Heavy Produce Committee of the Queensland Fruit and Vegetable Growers and the HRDC are gratefully acknowledged for their financial support of this project.

Ken White, Russell Simpson, Jim Caidwell, Des Jennings and Graeme Ingleton (Victorian Certified Seed Growers) kindly provided seed for the Gatton Research Station trials. We also thank farmer co-operators in southern Queensland and the managers of Gatton and Kairi Research Stations for their assistance. ■

Exports and imports

- where are we now?

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Russell Sully's story about the potato industry at the crossroads highlights the enormous export potential for the Australian industry. But where are we now? How much are we currently exporting and who to? How much do we import?

The following information has been compiled from data supplied by the Australian Bureau of Statistics and provides a summary of our trade in potatoes and potato products in 1996.

Terms and definitions

The potato and potato product categories in the tables are based on an international system used by customs groups around the world. The terms may seem a bit strange but hopefully most are reasonably self-explanatory. Where extra explanation is required a footnote to the tables has been added.

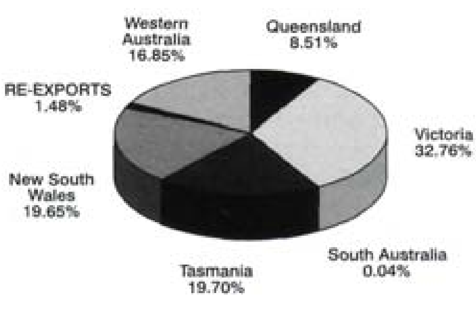
Exports are valued at the place where the goods are loaded on board the international carrier at the national frontier of the exporting country. The value includes all production and other costs incurred up until the goods are placed on board the carrier for export.

For exports, the state information refers to the state of origin not the state of loading. This is important as many goods may be transported to other states before leaving the country.

Re-exports are goods that are imported and then exported again in either the same condition or after undergoing some minor operations which leave them essentially unchanged (eg. blending, packaging, bottling, cleaning, sorting, husking and shelling).

Imports are valued at the point of containerisation (most cases) or at the port of shipment or at the customs frontier of the exporting country, whichever comes first.

State contributions to exports by value



Exports

The total value of exports of potatoes and potato products for 1996 was $23,311,642. As the table shows, this is made up of almost $10 million of frozen French fries and other frozen products and almost $6 million of fresh potatoes.

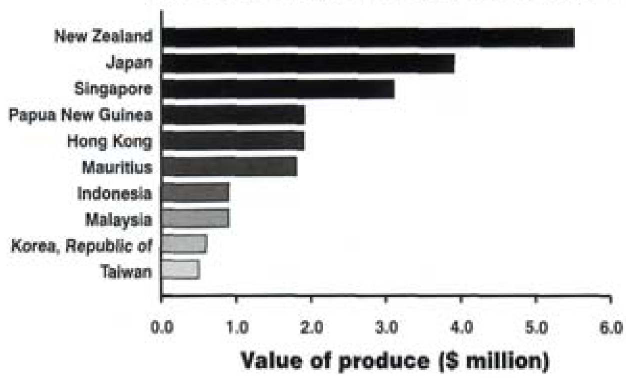
Value of potato and potato products exported in 1996

Potato and potato products	Value of exports ($)
Potatoes (excl. seed), fresh or chilled	5,945,940
Potatoes prepared or preserved otherwise than by vinegar or acetic acid, frozen (1)	9,962,624
Frozen potatoes, uncooked or cooked by steaming or boiling in water	1,194,962
Dried vegetables and mixtures thereof (excl. onions, mushrooms and truffles)	1,037,848
Potatoes prepared or preserved otherwise than by vinegar or acetic acid, not frozen (2)	2,472,915
Flour and meal and powder	1,306,336
Seed potatoes, fresh or chilled	1,349,422
Flakes, granules and pellets of potatoes	16,046
Dried potatoes	25,549

(1) Includes potatoes (chips or french fries) cooked or partly cooked in oil and then frozen
(2) Includes items such as potato crisps

It is interesting to note that the current top ten buyers of Australian potato produce are mostly our neighbours and other countries in the Asia Pacific region.

Ten largest buyers of our produce in 1996



Other buyers of our produce in 1996 included Brunei, Cambodia, Canada, China, Christmas Island, Cocos (Keeling) Island, Fiji, Former Yug Rep Macedonia, French Polynesia, French Sth Antarctic Terr, Greece, Kiribati, Myanmar, Nauru, New Caledonia, Norfolk Island, Philippines, Russian Federation, Samoa (American), Seychelles, Solomon Islands, Spain, Sri Lanka, Thailand, Tonga, Tuvalu, United Arab Emirates, United Kingdom, United States of America, Vanuatu, Vietnam and Wallis & Futuna Islands.

Imports

Despite the level of exports achieved above, Australia imported $30,911,945 worth of potatoes and potato products in 1996. Almost half was as frozen product and most of the rest as dried vegetables and mixes.

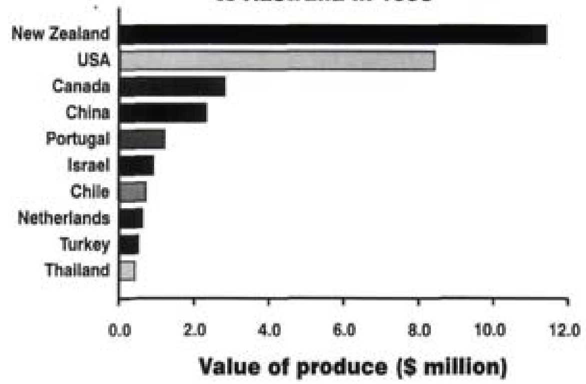
Value of potato and potato products imported in 1996

Potato and potato products	Value of imports ($)
Dried vegetables and mixtures thereof (excl. onions, mushrooms and truffles)	13,912,166
Potatoes prepared or preserved otherwise than by vinegar or acetic acid, frozen (1)	14,667,172
Frozen potatoes, uncooked or cooked by steaming or boiling in water	191,411
Flakes, granules and pellets of potatoes	1,624,152
Potatoes prepared or preserved otherwise than by vinegar or acetic acid, not frozen (2)	157,597
Dried potatoes	300,861
Flour and meal and powder	58,586
Potatoes (excl. seed), fresh or chilled	-
Seed potatoes, fresh or chilled	

(1) Includes potatoes (chips or french fries) cooked or partly cooked in oil and then frozen
(2) Includes items such as potato crisps

It will be interesting to watch how our potato trade equation changes over the next decade as we strive to develop the export potential available to us.

Ten largest sellers of potato produce to Australia in 1996



Other countries sending produce to Australia in 1996 included Austria, Belgium-Luxembourg, Denmark, Egypt, Former Yug Rep Macedonia, France, Germany, Greece, Hong Kong, Hungary, India, Indonesia, Italy, Japan, Republic of Korea, Lebanon, Malaysia, Pakistan, Philippines, Poland, Singapore, South Africa, Sri Lanka, Switzerland, Syria, Taiwan, Tonga, United Kingdom, Vietnam and Zimbabwe. ■

Robertson yields up 18%

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Robertson growers have proved that it is possible to improve sustainability, whilst at the same time increase yields and decrease input costs.

The Robertson District Potato Advancement and Landcare Association began implementing land management techniques in the early 1990's to manage soil erosion and maintain their sustainability as potato growers in the Sydney and South Coast water catchments. The land management techniques implemented meant a decrease in cropping land of up to 20%.

This led to the implementation of a three year research project in November 1993. The project was developed to allow farmers to work in conjunction with NSW Agriculture, Land and Water Conservation, Landcare and Lanz Agricultural Consulting to research ways of improving farm sustainability while increasing crop yields and decreasing input costs.

Areas investigated included irrigation, nutrition, pest and disease management, and minimum tillage. Other activities undertaken include field days, discussion nights, seminars, demonstration trials, district visits and a newsletter.

Achievements of the project

- Yield increases of 18% have been recorded over the 3 years the project has been running.
- Greater sustainability has been achieved through more appropriate use of chemicals and fertilisers.
- Growers are now aware of the latest technologies, products and support specialists and are able to implement this technology successfully into their crop management program.
- Strong links have been developed between growers, local government and state agencies demonstrating to the community that potato farmers are responsible primary producers.

A grower survey was conducted at the conclusion of the initial project to gain an indication of growers' perceptions of the project's success or failure. This survey showed that the adoption rate of new crop management strategies were as follows:

- minimum tillage - 54.5%
- irrigation management - 64%
- soil testing - 73%
- plant testing - 36%
- integrated pest management - 64%

The majority of these results show adoption rates well above the original goal of 40%. An average increase in crop yields of 18% was recorded and over 80% of growers indicated they had experienced a decline in input costs.

The work undertaken by the group identified major inefficiencies in irrigation practices and the need to develop strategies for managing phosphorus in krasnozem soils. These issues have begun to be addressed in the second stage of the project (1996-97). It is hoped to continue this work through a third stage of the project over the next three years and extend the activities to include the Dorrigo and Guyra districts.

The achievements of the initial project have been noted by other potato farming communities throughout Australia.

Acknowledgements
The project was funded by HRDC, RDPA&LA, Sydney Water and the Wingecarribee Shire Council. Technical support has been received from Guy van Owen, Department of Land and Water Conservation, Robert Spooner-Hart, UWS-Hawkesbury, Mike Robbins, NSW Agriculture.

Heads I water, tails I don't

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If irrigation decisions are not based upon some measure of crop water requirement, then they may as well be based upon the toss of a coin.

Heavy irrigation application rates are obvious as runoff.
This wastes water and fertiliser and causes soil erosion.

If a crop is either under watered or over watered then water is wasted and yield may be reduced. However, all too often, irrigation decisions are based upon the capability of the system and not crop water requirement.

Between 1994 and 1997, the growers of The Crisping Group of South Australia have undertaken an Integrated Crop Management Project with efficient irrigation the main focus.

Crop data, including water use and yield and quality information, was collated and compared at the end of each season. Some interesting trends and conclusions have come out of this data.

Wide variation in water applied

Grower records and estimates collected at the end of each season for the Adelaide Hills district showed that irrigation applications on crops in similar environments and with similar planting dates varied from 260mm to 720mm in 1994-95.

However we found no apparent relationship between yield and the amount of water applied.

This huge variation in water application was due to at least two factors;

- the amount of water the crop needs is only guessed on many farms
- irrigation applications are dependent upon the capabilities of the irrigation system

Irrigation decisions are consequently based upon these limitations and interpretations of the weather forecast.

How much water does a crop need?

The guesswork can be taken out by measuring soil moisture at several depths and backing this up with hands on observations with a shovel.

At demonstration sites in commercial crops, the Crisping Group measured soil moisture at several depths with DRW Microlink and EnviroScan monitoring systems.

Using this equipment and by looking at what was happening in the root zone, we were able to demonstrate that crops use different amounts of water depending on the stage of growth.

We found that growers tended to water their crops at the same frequency and quantity regardless of the stage of growth and water requirement of the crop.

Overwatering during early growth was commonly seen. At this stage roots were relatively shallow and very active, rapidly using any moisture available within the hills. Light but frequent applications of water would have best matched plant requirements.

In mid-season we found that crops were often dry and water stressed. At this growth stage, roots were active at depths of up to 50cm and the crop required heavier applications allowing the water to penentrate down to the deeper roots. Both shallow and deep roots died if they were stressed in dry soil.

Towards the end of the season, we found that growers correctly used crop colour changes to predict lower water requirements. Reducing the amount of water at this time appeared to maximise the specific gravity of tubers at harvest.

The results suggest that the common crisping variety, *Atlantic,* grows best under high soil moisture regimes. Consistently moist conditions appear to maximise yield and quality, whilst dry conditions during mid-growth and over-wet conditions during late growth may reduce specific gravity.

Delivering the right amount of water

System limitations

Under a solid set system that is turned on in sections, or a system that is slow and covers a lot of ground (eg travelling boom) the crop must wait for water in turn.

Typically, irrigation applications under these systems are heavy and wasteful and too infrequent, resulting in wasted water and pumping dollars, crop water stress, uneven growth and lost production.

Under a centre pivot, water may be applied lightly and as frequently as every 24 hours, which could be too often.

Improving system efficiency

Growers can increase the efficiency of any of these systems by checking pressures, flow rates and distribution uniformities under the sprinklers. Sprinkler wear and pressure drops in pipe lines that are too long or too narrow are common faults that can be identified and corrected simply.

Monitoring systems

In this project we were able to demonstrate that irrigation efficiency can be improved by monitoring soil moisture levels.

Some growers perceive that soil moisture monitoring equipment is expensive, complicated and largely unnecessary.

But for those growers who wish to improve yields, quality and profit-ibility, this technology is capable of providing the information to help achieve this goal.

Acknowledgements This work is supported b' the Smiths Snackfood Company and jointly funded by The Crisping Group of South Australia and HRDC.

HRDC

■

Irrigating potatoes - how are we going?

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There is still room for improvement in our irrigation of potatoes destined for the fresh market.

This was one of the findings from recently completed projects, where our team from Gatton Research Station (GRS) collaborated with 19 producers in monitoring irrigation management in fresh-market and crisping potatoes.

We checked on 34 crops during 1994-1996, using tensiometers to measure soil water status and estimate crop water use. We found that using tensiometers enabled many producers, both fresh-market and crisping, to judge the value of intermittent rain and extend irrigation intervals without stressing their crops.

In experimental work at GRS, we obtained the best yields when potatoes were irrigated when the shallow tensiometers (installed 20 cm below potato hill tops) gave readings of about 40 kPa.

In early growth stages this generally meant applying 20-25 mm every 5-7 days. During peak growth these requirements increased to 30-35 mm per irrigation. These values are only guides and need slight adjustments for different soils, climates and water qualities.

In the commercial crops monitored, fresh market producers tended to water their potatoes less frequently than their crisping counterparts (see table), although they applied more water per irrigation (30 mm vs 25 mm). As a consequence, some of the fresh-market crops suffered periods of water stress which reduced yields.

Averaged across all monitored sites, daily water use of fresh-market crops was around 25% lower than in corresponding crisping potato crops (see table). Some of this was attributed to the crisping crops being grown in warmer conditions. However, yield values from the two groups confirmed higher average productivity from the higher water use crops.

Irrigation practices of fresh market and crisping potato producers.

	Fresh	Crisping
Peak tensiometer value before irrigation	60kPa	50kPa
Average interval between irrigations	9.5 days	7 days
Average daily crop water use	3.1 mm	4.4 mm
Marketable yield	29t/ha	34t/ha

Experimentalists Dan Galligan (left) and Rob Cairns checking tensiometers in potatoes.

Surprisingly, we found that fresh-market producers with solid-set sprinklers did not appear to be taking advantage of the flexibility of their system to water when crops were first encountering stress. Irrigation was often delayed, so that intervals between waterings were similar to those producers who used hand-shift systems.

In contrast, crisping potato producers with solid-set or linear-move irrigation systems did water more frequently than those with travelling guns or hand-shift lines.

As these exercises took place during the worst drought in the irrigated history of southern Queensland, delays in watering were not entirely unexpected. Interestingly, there were also several examples in both groups where excessive irrigation led to significant deep drainage of water.

We are reasonably confident in offering irrigation management strategies that can maximise yields and irrigation efficiency in potatoes.

However, relationships between irrigation and tuber quality aspects, such as specific gravity (important for processing) and brown fleck/brown centre/hollow heart, are less clear. These may be worth further investigation.

Acknowledgements
Our work has been generously funded by the HRDC, Queensland Fruit and Vegetable Growers, and the Southern Queensland Crisping Potato Group. Their support and collaboration, along with our network of cooperative producers, have been essential, and are gratefully acknowledged. ■

IPM in action

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Integrated Pest Management (IPM) can reduce costs substantially by avoiding unnecessary sprays.

Demonstrations of regular monitoring for both pests and beneficial insects have been successful in showing growers in districts as far apart as Atherton, Manjimup and Thorpdale how they can save money using IPM techniques.

In some cases this has led to savings of thousands of dollars per season without any loss of either quality or yield.

These savings were achieved through weekly monitoring of crops by crop scouts. Monitoring allowed growers to either avoid using insecticide sprays or to time applications more precisely.

In one district, routine early sprays for aphids were eliminated when it was shown that no aphids were present in the crops throughout the season.

Similarly, growers concerned about tomato spotted wilt virus could reduce insecticide sprays because by monitoring they knew when, and if, they had onion thrips invading their crops. In almost all cases monitoring indicated that only plague thrips (which do not spread this virus) were present and so sprays were saved.

Monitoring usually gave growers the confidence to avoid mid-season insecticide applications and to rely instead on biological controls. Cultural control methods replaced most late sprays. However, some seed growers used insecticides once the tops had been removed.

For pests such as thrips, potato moth, armyworm and Rutherglen bug, which invade the crop from surrounding areas, border sprays were used instead of full field sprays. This enabled good control, without killing all the beneficial species.

A brown lacewing, an important predator in potato crops

A female Orgilus wasp stinging a potato grub which is beginning to burrow into the tuber

Biological control now playing a much larger part in management decisions

Regular monitoring of potato crops includes looking at naturally occurring biological control agents as well as pests. In this way information on the relative numbers of pests and beneficials is available from the grower's own crop. This means that decisions on pest control take into account more than just the presence of pests.

Australian growers are now leading the world with the use of augmentative releases of parasitoid wasps. That is, regular releases are made of wasps which kill potato moth caterpillars so that these biocontrol agents are established in the crop much earlier in the season.

Some of the beneficial insects that we now regard as significant in controlling pests include predatory damsel bugs, green and brown lacewings and several species of parasitic wasps.

Previous surveys of crops had shown that one key beneficial species of wasp that attacks potato moth was absent in Western Australia, although it was present in all other states.

Releases of this species, *(Orgilus lepidus),* over the past season have been made in the south west of WA. These wasps were produced by IPM Technologies P/L and released in Manjimup by Stewart Learmonth of Agriculture WA. Sampling in future years will determine how well the wasps have succeeded.

How to get started in IPM

Growers interested in using IPM on their farm can contact either Paul Home, their local potato advisor or Department of Agriculture for information on how to get started.

Acknowledgements
This project was funded by HRDC.
We thank all potato growers and crop advisors who helped with this project, and also Rod Lay at McCains Snackfoods and Keith Blackmore of VicSPA. Photos have been provided courtesy of photographer, Denis Crawford.

HRDC ■

Rumler Brothers grow certified seed in Victoria

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Bill and Ted Rumler are third generation farmers at Wattle Flat, near Ballarat in the Central Highlands of Victoria.

Their grandfather purchased the original block of 190 acres in 1910. Bill and Ted have added to the farm which now consists of 340 hectares (840 acres).

Their main farming enterprises are sheep and certified seed potatoes. The main sheep enterprise is purchasing store lambs for refattening over the summer period in conjunction with their Poll Dorset stud which produces 150 flock rams annually.

The Ballarat district is well proven for producing certified seed and French fry processing potatoes for McCain Foods (Aust) Pty. Ltd.

Bill has been a valued member to the Victorian Certified seed potato industry for many years as President of the Ballarat Certified Potato Growers' Committee and a delegate to the Victorian Certified Seed Potato Growers' Committee. The appointment of Rumler Bros as Foundation Seed growers was recognition of their success and consistency as certified seed growers.

ViCSPA scheme

As members of the Victorian certified Seed Potato Authority Inc. (ViCSPA) their potato enterprise revolves around certified seed. They have a long history of seed growing, producing "Approved" seed in the 1960's and moving to "certified" seed growing in 1969.

Kennebec used to be the main variety grown by Rumler Bros for Approved and Certified seed production for sale to crisp and French fry growers and fresh market production in South Australia.

Bill and Ted are currently Foundation Seed growers for the Victorian Seed Potato Certification Scheme for the varieties *Atlantic* and *Denali* as well as producing certified seed of *Atlantic*, *Shepody* and *Russet Burbank*. The *Shepody* is produced under contract for McCains Foods (Aust) Pty Ltd. This last season they planted 32 hectares of potatoes. All were submitted for inspection under ViCSPA's Victorian Seed Potato Certification Scheme.

All of their potatoes are derived from minitubers produced by ViCSPA accredited laboratories and multiplied up to either Foundation seed over three years or certified class seed over five years.

All of the seed must pass two field inspections conducted by ViCSPA . Generations one to three must meet very high health standards.

David Longridge, Bill & Ted check a line of *Shepody* Certified seed.

All of their crops are soil sampled according to the ViCSPA protocol and tested for the presence of potato cyst nematodes by the Agriculture Victoria laboratory at the Institute for Horticultural Development at Knoxfield.

While the seed scheme has always had a nil tolerance for bacterial wilt, the disease has never been detected in the Ballarat district.

The Victorian Seed Scheme In Summary

Seed Districts:	**Gippsland, Kinglake, Central Highlands, Otways & Portland**
Grower Members:	**115 (33 on Quality Assurance)**
Hectares Grown:	**2020**
Tonnes certified:	**34,300 (more than 50% from QA)**
Varieties Grown:	**50**
Major Varieties:	***Atlantic, Sebago, Coliban, Sequoia, Russet Burbank, Desiree, Exton, Crystal, Pontiac, Red La Soda, & Denali***

Move to autumn harvesting

Bill says that with their lighter soil types and some lower country it is important to harvest the seed before the soil gets too wet. Over the last few years they have moved to improve their harvesting by:

- upgrading their single row harvester to a two row harvester
- extending the sheds for extra storage space
- purchased enough bins to store all the crop and
- growing the varieties *Shepody & Atlantic* that allow an earlier start to harvesting.

The earlier harvest also improves seed quality resulting in seed with cleaner skins which cures well in the autumn weather and which is easier to grade. Harvesting soon after maturity also reduces the carryover of soil-borne diseases such as silver scurf, rhizoctonia and black dot.

Bill also believes that harvesting under the often ideal autumn conditions, as compared to wetter and muddier winter conditions, maintains the soil structure, is easier on machinery and improves the Rumlers' life style. This year they completed harvest in mid May.

Quality Assurance (QA)

The Rumlers are also registered ViCSPA Quality Assurance growers who have their own quality management plan. Their QA Manual outlines their management practices and the documentation required. ViCSPA audits their operation at least three times each year. Two of the audits are unannounced.

The QA agreement allows the Rumlers to inspect their tubers and, where appropriate, to certify them. When asked about the benefits of the QA program Ted replied that it reinforces good management practices.

Their employee, David Longridge is the Quality Control Officer who is responsible for the assessment of quality after grading. David selects the sampling procedure from a reference in the Rumler Bros. QA Manual and checks and records the quality of each lot presented for Certification. David says that he is now much more aware of tuber quality.

Bill agrees, adding that he felt that they were now even better at grading their seed. When asked why they had joined the QA program, Bill replied that their aim was to provide a better quality product that was more acceptable to buyers.

The crop cycle

The farm rotation averages out at about 8 years between potato crops. The Rumlers strongly believe that with their lighter soil type they must not over-crop it and therefore have a long period of rest between crops. The long rotation also is beneficial for the health of seed crops by reducing the level of soil- borne pathogens and controlling self sown potatoes.

The preparations for planting commence in July with mouldboard ploughing. The remaining cultivations are carried out prior to planting in November. At planting, a 5.1.2 low analysis fertiliser is applied at about 1000 - 1250 kg/ha (8 to 10 cwt. per acre). All crops are irrigated and harvesting usually commences in the third week in March.

By late May the Rumlers sow oats (to be used to fatten store lambs if required) and sow pasture on last-years' potato paddocks. June and July are spent grading their seed for their buyers.

The Rumler Bros have developed their farming operation to suit their land and climate and through good management are producing quality certified seed for their buyers. ■

Roger Osborn from ViCSPA inspecting a generation 1 plot of *Atlantic* grown from mini tubers

Silver scurf - a mere blemish?

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The demand for washed, clean-skinned potatoes has meant that silver scurf is becoming more than just a skin blemish.

Silver scurf, caused by the fungus *Helminthosporium solani,* significantly reduces the attractiveness and marketability of washed potatoes. It also reduces the quality of potato crisps because the diseased skin shows up as a dark edge on the cooked crisps.

Symptoms

Silver scurf first appears on tubers as more or less round, brownish patches, eventually turning silvery in colour. The entire tuber surface can be covered with silver scurf.

The fungus lives in the outermost cell layers of the skin of the tuber. The outer cells become detached allowing air to penetrate causing the silvery sheen. The affected skin is more permeable resulting in moisture loss and shrivelling of the skin.

Generally, silver scurf does not affect crop growth, productivity or eating quality. However, severe infection can result in weight loss in stored tubers and severe shrivelling can reduce sprout vigour.

How silver scurf spreads

Disease spread in the crop

Silver scurf can be spread by infected seed and possibly contaminated soil.

When affected seed is planted, masses of spores are produced by the fungus and these spores infect the developing tubers. Lesions develop over the tuber surface as the season progresses and the longer tubers are left in the ground after plants die down, the more severe the disease becomes.

Field trials in Victoria suggest that soil may also be a source of infection. This means that the disease may occur when crops are planted into old potato ground even if clean seed is used. It also means that clean tubers may become infected anytime they come into contact with contaminated soil, such as during handling and storage. Further research is under way in Australia, USA and UK.

Silver scurf on tubers of the purple skinned variety *Toolangi delight*

Disease spread in sheds and stores

Spores become airborne during handling and storage, thereby spreading the disease to other tubers and is probably one of the causes of silver scurf in very early generations of seed potatoes.

Silver scurf has become a serious problem in stored processing potatoes in both Australia and the USA. The relatively high temperatures (10°C), high humidity (above 95% RH) and constant airflow in bulk storage sheds results in several infection cycles before potatoes are processed. As a result the majority of tubers of susceptible cultivars can become severely infected after prolonged storage, causing reduced quality of the processed product. The disease is not so common in potatoes stored at 3°C or less.

Managing silver scurf

The management of silver scurf involves the integration of cultural and chemical control strategies. Research is currently being conducted in Victoria to evaluate various aspects of the integrated control of silver scurf.

Fungicides

Thiabendazole (Tecto Flowable Fungicide) is the only fungicide registered for the control of silver scurf in Australia. It is applied to tubers after harvest and acts by preventing the fungus from producing spores in silver scurf lesions.

However, thiabendazole resistant strains of the fungus now occur in Europe and North America and most of the fungal samples tested in preliminary studies in Victoria were also found to be tolerant to the fungicide. This explains, in part, why this disease has become difficult to control.

Several fungicide treatments are used to control silver scurf in Europe. Most of these have not, as yet, been tested or registered in Australia. Trials are currently under way in Australia to evaluate some of these chemicals.

Integrated control

Research in Europe has shown that minimising the build-up of silver scurf in successive generations of seed potatoes is the most important strategy in managing silver scurf. Components of this strategy would include:

Hygiene: Preventing seed being contaminated during handling and storage will help minimise the build-up of the disease from generation to generation.

Time of harvest: Silver scurf continues to develop on tubers left in the ground after tops have died off. Harvesting as soon as practicable after plant senescence minimises the development of the disease on tubers.

Chemical treatments: Post-harvest fungicide treatments prevent the fungus from producing spores, thereby minimising build-up and spread in storage and the subsequent transmission from seed to daughter tubers.

Storage conditions: Silver scurf spreads extensively under warm and humid conditions. Ensuring that tubers are allowed to dry as soon as possible after harvest helps prevent disease spread, especially if potatoes are harvested under wet conditions with soil adhering to tubers. Preventing condensation during storage also minimises disease development.

Seed growers planting in fresh ground (not previously cropped to potatoes) have the best opportunity to minimise the build-up of silver scurf with each successive generation by adopting the management strategies outlined. Different strategies will need to be developed if it is confirmed that spores surviving in soil are also a source of infection of seed potatoes.

Acknowledgements
This project has been funded by the HRDC.

■

Potatoes in a pocket

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To many the title will probably conjure up the thought of growing potatoes in a small creek pocket - an area of fertile alluvial soil.

But no, I am talking about the sale of fresh market potatoes in a 10 kg paper packet known as a paper pocket in South Africa.

I had the opportunity to attend the 3rd World Potato Congress held in Durban South Africa in March this year. Here, part of the program featured the South African potato industry which is slightly larger than the Australian industry (1.4 compared to 1.2 million tonnes).

A major difference is that only 7% of the South African crop is processed compared with approximately 50% in Australia.

The South African industry is a dynamic one that is organised on a national basis by the Potato Producers' Organisation (PPO). In 1990, this farmer's body introduced the 10 kg paper pocket as the standard marketing package.

Potatoes are machine harvested and then shed graded into the paper pockets. The colourful pockets are stacked neatly in 100 pocket lots (1 tonne) per pallet.

Shed grading into 10 kg paper pockets

The 10 kg pockets are the most popular form of potato sales in the supermarkets, the chief outlet for sales in South Africa. They are also popular in the growing street trade which now accounts for 30% of potato sales.

By reducing from 25 and 20 kg bags to the 10 kg bags, there wasn't a proportionate reduction in the price received by the producer. In fact there has been a significant financial advantage to the grower as a result of packaging in the smaller container.

The paper pockets are popular with the consumers as the brightly coloured packages are an attractive way of storing the potatoes once purchased because they restrict tuber greening.

The paper pockets are also popular in side walk markets (The 7.99 S. African Rand is roughly A$2.30)

The PPO has also introduced a quality assurance scheme whereby all producers have a set of visual standards for grading and classifying their product which is then clearly marked on the pockets.

The PPO employs staff at fresh produce markets to inspect a sample of all consignments. Any departures from the grades marked on the pocket are immediately communicated to the relevant producers so that the problem can be corrected.

Consumers can also pass on complaints to inspectors who again contact the relevant producer. This is a positive approach to maintain reliable quality rather than a negative policing policy.

With the introduction of quality assurance into the Australian fresh potato industry, I feel it is timely that we look closely at the success of the smaller attractive paper pockets being used in South Africa.

The requirement for shed grading to implement a successful quality assurance scheme should provide an opportunity to market potatoes in a more attractive and manageable package.

Acknowledgements
Funds to attend the Congress were provided by the Queensland Department of Primary Industries. ■

Uniform spacing makes a difference

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Marketable yields and gross returns can be increased by more uniform spacing between potato plants.

The Department of Primary Industries and Fisheries (DPIF) in Tasmania has conducted trials to determine how variation in the distance between seed pieces affected the yield of Russet Burbank.

All treatments were planted with the same population density or number of plants per hectare. Spacing uniformity ranged from perfect (no variation) to poor (high variation) of distance between seed pieces

Uniform spacing increased the yield of 100-250g tubers and decreased the yield of second growth tubers. The yield of tubers less than 100g, greater than 250g and green tubers did not change.

The following table shows how the variation in spacing (measured using two different approaches - Acceptable Spacing Index and Coefficient of Variation), affected marketable yield and estimated gross return/ha.

Spacing uniformity	Acceptable Spacing Index (%)	Coefficient of Variation (%)	Marketable yield (t/ha)	Average gross return * ($/ha)
perfect	100	10-20	51	9700
excellent	90	23-31	50	9480
good	80	34-43	48	9290
average	70	45-55	47	9050
poor	60	56-67	45	8810
terrible	50	67-79	44	8620

* Based on a price of $190 a tonne

With the potential to improve returns by about $500/ha (i.e. improving the spacing uniformity from poor to good), attention to spacing uniformity is worthwhile, particularly since the means of doing it are within the control of the operator through good seed cutting, and proper planter maintenance and operation.

Measuring uniform spacing in the field

Calculating how uniform the spaces are between potato plants or seed pieces is normally done by taking measurements and using a computer or calculator to work out the Coefficient of Variation (cv). This is fine if you have the means to do it (a computer or calculator) and an understanding of the statistical theory. For most people a more simplified approach is needed.

As part of the DPIF trials we investigated the use of Acceptable Spacing Index (ASI) to measure how uniform spacing is between plants or seed pieces. The main advantage of using ASI is that it is easy to calculate - you do not need a calculator or computer.

ASI is defined as the range from half the target spacing to one and a half times the target spacing. The target spacing is the desired distance between seed pieces.

Anything that falls in between is regarded as being within the acceptable spacing range. Those seed pieces that are closer than half the target spacing are referred to as "doubles", and those that are further apart than one and a half times the target spacing are referred to as "misses".

For example: Assume our aim is to have 35 cm spacing. The "acceptable range" is from 17.5 cm (½ target spacing) to 52.5 cm (1½ times target spacing). Uncover 51 seed pieces (50 spaces between seeds) for each row of the planter. If 35 of the 50 spaces lie between 17.5 and 52.5 cm, the ASI is 70%; if 42 spaces lie between 17.5 and 52.5 cm, the ASI is 84%, etc.

Growers should aim for an ASI of at least 75%, and preferably in the 80's.

Achieving the correct population density is important as it can impact on the number of plants a grower will end up with in a field. **Too few or too many plants will reduce marketable yield.** In addition, if the spacing between plants becomes too uneven, marketable yield will also be affected.

Uniform spacing lies in the hands of the operator. It comes down to paying attention to seed size and shape, and planter calibration, maintenance and operating speed.

Even with all these details under control, you will be flying blind unless you take the time to get off the tractor, uncover a reasonable length of row, measure the spacing between seed pieces and do the necessary calculations.

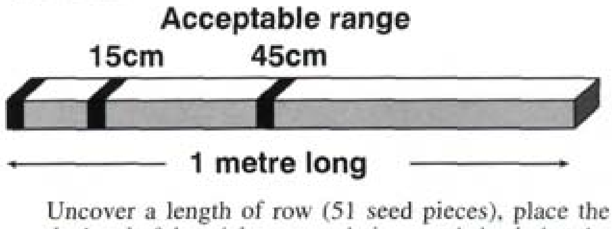
John and Bruce have prepared a ready reckoner for field use. Anyone wanting one should contact them directly. ■

Making and using a measuring stick

A simple device can be quickly made up to help you check whether the seed falls within the "acceptable range".

Using a straight piece of wood about a metre long, measure from one end half the target spacing and one and a half times the target spacing, and mark these points. Also mark the end from which the measurements were taken so you know which end to use.

So for a 30 cm spacing there would be marks at 15 cm and 45 cm.



Uncover a length of row (51 seed pieces), place the marked end of the stick on a seed piece, and check that the next seed piece falls between the next two marks, in this instance between the 15cm and 45cm marks. Repeat for each seed piece.

Keep a tally of the number of seed pieces that fall in the "acceptable range" and work out the percentage by multiplying the result by two.

Unfortunately, the stick won't uncover the seed pieces or do the sums for you!

The menagerie grows

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Remember last year's story on LAPDOG, the Lucky Atherton Potato Options Group, a group of growers who want to develop better ways of growing potatoes.

Now LAPDOG has been joined by TOPCATS (Team of Potato Croppers on the Atherton Tablelands). Any temptation to refer collectively to these groups as the FLEABAGS has been strongly resisted.

Together, these self help learning groups have continued to address problems that are of major concern to them. Mike Hughes of QDPI has been working with the new group.

The group has been very active, with members meeting monthly and learning how to reduce pesticide use with Integrated Pest Management (IPM) techniques, undertaking fertiliser trials and monitoring crop water use. They have also undertaken several trips to other potato growing districts.

IPM

IPM trials and demonstrations continue to be the most active on-farm events. Growers have learned to manage pests rather than trying to eradicate them entirely.

Regular weekly monitoring has allowed growers to avoid routine spraying and when they do spray specific insecticides are used targeting the actual pest that is there rather than broad spectrum ones. There are now very few growers who regularly spray broad spectrum insecticides.

High aphid loads and early caterpillar *(Heliothus)* damage caused a lot of pressure to return to 'old ways' but this was largely resisted.

Members of LAPDOG are shown recent potato plantings by the Penna family.

Another visit by Victorian entomologist, Paul Home, was helpful in clarifying some points in IPM and in setting up further on-farm studies in predator release for tuber moth. Growers are very keen to promote high levels of beneficial insects in their crops.

Fertiliser and irrigation

Members continue to trial fertiliser types and rates as well as closely monitoring water schedules with tensiometers.

They have found that under their irrigation regimes, medium analysis fertilisers (such as 11:12:19) are more cost effective than either the high analysis mixes (e.g. 18:20:18) or the low analysis mixes (e.g. 5:6:7). This year they are going to look further at nitrogen use, particularly foliar application and whether it affects the incidence of target spot.

Using tensiometers to monitor water use in their crops has given members more confidence in their irrigation practices and has caused some growers to alter their irrigation frequency to better match water requirements.

Visits

Crisping growers - Penna family

The group visited a large crisping grower (Guilio Penna and Sons) near Charters Towers with a stopover at a packing plant in Townsville. The group gained a much better appreciation of the importance of seed quality and the influence of seed maturity and of whole seed on subsequent populations and yield.

The Pennas also emphasised the importance of avoiding bruising by harvesting when the tuber temperature is as close as possible to 20°C. They achieve this by a combination of irrigation to cool the tubers and harvesting in the cooler times of the day.

Robertson district

Some members attended the Robertson District Potato Advancement and Landcare Association's Potato Seminar. The highlights included use of minimum tillage, IPM activities, attention to nutrition and irrigation techniques.

The district tour was very much appreciated by our group and members have taken a much closer look at their own fertiliser requirements and IPM strategies since this visit.

Victorian and New South Wales certified seed growers

Other group members went even further south to visit certified seed growers. This visit enabled seed and ware growers to gain an understanding of each others needs and problems concerning seed quality. The ramifications of changing criteria for disease levels in certified seed was also explored.

Sydney markets

Growers also visited the Sydney fresh potato markets to gain an understanding of how the markets operate and what merchants and consumers require in a fresh potato.

The spirit of cooperation and shared learning remains the basis for this extension project.

Acknowledgements
Contributions from HRDC and QFVG are gratefully acknowledged.

HRDC

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Common scab - a major potato disease in Tasmania

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Common scab is a serious disease of potatoes grown for processing and fresh market in Tasmania.

It is caused by the soil inhabiting bacteria *Streptomyces* spp. Tubers with scab have rough and circular affected areas that may be raised, level with the surface or sunken. Hence various types of symptoms are known to occur: russet scab, raised scab and deep-pitted scab. The type and severity of the scab symptoms will also be influenced by the type of *Streptomyces* bateria present and the age of the affected areas.

The disease invades through immature lenticels just as the tubers are beginning to form and affected areas continue to expand as the tubers enlarge throughout the growing season. Mature tubers with a well-developed skin are not susceptible to new infections.

The problem

Common scab has been identified by growers as the most serious disease threat to the Tasmanian potato industry.

This disease can seriously affect growers' income through partial or total rejection of severely affected crops, deductions in yield based on incidence and depth of scab lesions by processing companies, downgrading of affected seed potatoes to processing quality, reduced land available for potato seed production, and reduced quality and marketability of potatoes destined for the fresh market.

It affects all varieties grown for processing and the fresh market in Tasmania.

Research

The severity of common scab disease is dependent on favourable conditions in the paddock. It is important to understand these conditions when developing management strategies.

Surveying for common scab

Common scab lesions on *Russet Burbank*

Soil moisture during tuber setting has been identified as important in the development of the disease. The disease is not active in moist soils. High soil moisture over a period of 6-8 weeks from tuber initiation can limit the severity of the disease.

However, the use of extensive irrigation for common scab management may promote other problems such as powdery scab, *Rhizoctonia*, *Sclerotinia* and bacterial rot. This highlights the importance of developing management strategies that take into account the range of diseases likely to be present and the needs of the crop and requires a good understanding of what is happening in the paddock.

Serve-Ag Research is currently conducting a three-year research project aimed at investigating and developing control strategies for common scab.

The focus of the project is to obtain a better understanding of the influence of field conditions and cultural practices on common scab incidence and severity, and in developing and integrating chemical control programs with cultural practices.

Field survey

In the 1996-97 season, the first year of the project, a field survey was conducted by Serve-Ag Research on scab infected fields in order to identify paddock conditions or cultural practices that could influence common scab disease incidence and severity.

Information collected in the survey included seed quality and treatment, soil preparation, planting date and condition, lime application, previous crop rotations, scab disease history, soil analysis, soil type and management practices that may affect the amount of scab.

The information collected in the survey will assist growers in obtaining a better understanding of the field conditions and cultural practices that influence the two scab diseases in Australia.

An interesting observation was that many growers, agronomic consultants, field officers and extension officers had difficulty distinguishing common scab from powdery scab. The high soil moisture regime that is recommended during the tuber initiation period for control of common scab, is conducive to severe powdery scab. The ability to distinguish the two types of scab is critical in determining how to manage water to reduce scab.

Of the 25 properties with the variety *Russet Burbank* that had a scab problem, 64% were affected by common scab, 24% by powdery scab and 12% by both types of scab. Field conditions were important in determining what scab was present.

For example, powdery scab tended to be prevalent in the high rainfall Forest-Smithton area and in poorly drained soils.

Common scab tended to be more common in the drier and warmer North-East region and on well drained soils.

Tubers in some paddocks were infected by both common and powdery scab indicating that both diseases were present in the fields and that conditions favourable to both scab diseases could occur.

When the information was analysed important trends started to appear.

Factors that appeared to increase common scab disease were poor seed quality, 6 years or less between potato crops and conducive soil conditions as affected by poor drainage, poor soil structure and soil compaction.

In some paddocks where potatoes had never been grown before, the incidence of common scab disease appeared to be related to the seed line used. It is unclear whether this was due to poor seed quality, such as scab infected seed, or increased susceptibility to scab disease as a result of a weaker seed line.

Contamination of seed during the handling process or contamination of paddocks through the movement of dirt on machinery may also be a factor.

Common scab tended to increase when there was fewer years between potato crops. It also remained a problem in ground that had potatoes five to six years ago. In many paddocks, the disease in the current crop tended to become more widespread and severe compared to the previous potato crop. This indicated an increase in the disease in the soil and the spread of the disease possibly through machinery during the soil preparation process, volunteer potatoes or by other means.

The influence of crop rotation appears to be related to either improvement or deterioration of soil structure. In an area prone to recurring common scab problems, a decrease in scab disease severity was noted in parts of the field that had improved soil structure due to the crop rotation. The severity of common scab tended to increase in potato crops grown in poorly structured or compacted soil.

Serve-Ag Research will continue this survey in the 1997-98 season.

Chemical controls

Trials in New Zealand, South Africa and Japan showed that chemical treatments could reduce scab severity and increase marketable yields when applied to seed or soil. Fungicide seed treatment is beneficial mainly when planting potatoes in new ground. Alternative soil treatment methods must be considered for controlling soil-borne scab inoculum.

Different types of chemicals and application techniques are currently being evaluated by Serve-Ag Research for use in the management of common scab.

Acknowledgement
This project has been funded by the HRDC.

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Growing potatoes is not only about soil, water and plants - it's about people

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A recent study of the Tasmanian potato industry has demonstrated that people are one of the most important, yet least valued, resources of the industry.

The results show that if the industry wants to move ahead, it needs to:

1. Ensure each industry player demands the best possible service from all of the other industry players, whether they be company field officers, growers, machinery contractors, consultants or government agencies. In turn, each industry player should be aiming to provide the best services - whether it be the best advice, the best equipment, the best marketing or the best product.
2. Improve its relationships, particularly between growers and contracting companies, but also from grower to grower; grower to consultant and grower to machinery contractor.
3. Recognise and value the role of all the players in the industry, particularly machinery contractors, the spouse and seed growers.
4. Seek ways to utilise the skills of all the people in the industry to take advantage of new opportunities, whether they be export seed potatoes, specialist fresh market potato production or other crops.

These recommendations are drawn from recent research under the HRDC project "Improving the adoption of advanced potato production and handling practices". This involved a comprehensive telephone survey of over 150 Tasmanian potato growers.

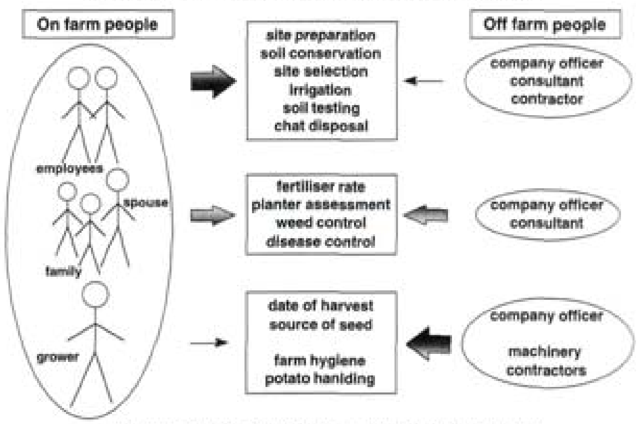
The purpose of the survey was to examine farmer decision making under contract potato production where product is forward sold to a processor or merchant at a specified price. This information will provide a better understanding of the people in the potato industry, and their roles and give some indications of how the industry could be improved.

For one particular potato crop, questions were asked about who contributed to decision making, the value of these contributions, who actually made particular decisions, what decisions were made, and how did growers feel about the people they had worked with.

The results showed that on average, each grower consulted with about six different people about their potato crop. Over the period of a year, this amounted to an average of 90 discussions relating to potatoes.

About 35 of these discussion were with people outside the family and about 55 were with people within the family. About 38% of growers said they discussed the crop with their spouse and their family, up to 61% discussed their crop with a machinery contractor (used for cultivating, spraying, planting,

Who influences potato growing decisions?



(Arrow size describes degree of influence of people on the decisions)

harvesting and cartage), 60% discussed it with a consultant (this includes people selling product and advice), and 38% discussed the crop with their company field officer. Most growers did not report discussing their crop with another grower.

Growers were asked to rate the value of the contributions of these people to the success of the crop. As expected, growers nominated themselves as having the most influence. Next most important was the seed grower, then the spouse and family, then consultants, contractors and company field officers. While seed growers ranked second in terms of their influence on the success of the crop, only 13% of growers reported speaking to these people regarding their potato crop.

The results demonstrated there are many contributors to potato production, with each having a role to play. Growing potatoes in Tasmania is not only about plants, soil and water, it's about people. Potato production is by no means a one person show.

Growers were also asked what decisions were made with respect to crop production, and who had the final say. Decisions fell into three categories. The first category was where growers said they made all the decisions themselves, as in water and land use. Here growers said they made decisions about working the soil, soil conservation, site selection, irrigation monitoring and soil testing.

The second group of decisions were those shared between growers, consultants and company officers. Decisions about crop inputs fell into this category: 25% of growers said advisers and field officers made decisions about fertiliser rate, planter assessment, weed control and disease control.

The last group of decisions were those that most farmers said were made by someone else. Sixty percent of growers said field officers made decisions about seed and the date of harvest, and 60% said contractors made decisions about farm hygiene and potato handling.

When growers were asked how they felt about the different groups of people they were working with, the results were mixed. Some felt contractors did a better job than farmers, others didn't. Some felt advisers selling chemicals gave biased information, others didn't.

Most, however, did not feel that they lost control of how they grew their potatoes. But the majority felt that agricultural or financial people or businesses outside the farm had a moderate or large control over their potato production and their whole farm.

Overall, potato production system is a complex interaction of people and activities, with growers behaving as managers of large businesses, focusing their attention on how best to allocate financial, physical and human resources.

Growers used many people, and most of these made a valuable contribution, whether it be providing support, advice or expert equipment and skills. In some cases, growers delegated decision making to advisers and consultants and specialist tasks such as harvesting and planting, to contractors.

These results indicate there are many opportunities for improvement within the industry. Growers, for example, can work to improve their relationships with machinery contractors and consultants by trying to establish clear lines of communication early on, giving clear guidelines on what is expected and then following up with objective feedback on the contractor or consultant's performance.

Machinery contractors can try and improve their services by endeavouring to provide the best equipment, and the best operators, to their clients. This may even extend to developing quality assurance schemes for potato planting and harvesting contractors.

Government, growers and industry can work to develop better ways of helping growers communicate with one another, and with other members of the industry.

The complete findings of this research are being reported in a thesis, and in a final report to the HRDC next year. This report will cover issues such as levels of adoption of best practice in the Tasmanian potato industry, grower goals and attitudes, grower decision making practices, industry communication channels, the role of the private sector in extension, guidelines for the development of effective extension strategies and guidelines for effective delegation of farm tasks.

Acknowledgements
The work would not have been possible without the participation of 150 potato growers, 15 farm families, 35 industry service personnel and a team of dedicated interviewers from Myriad Consultancy, a Tasmanian research firm. To all those who participated, thank you.The author would also like to thank the HRDC, the Australian Post Graduate Award, the Tasmania Institute of Agricultural Research and the Department of Primary Industry and Fisheries for funding this research.

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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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Printed by
Sprinta Print Pty Ltd
☎: (03) 6334 0595
Fax: (03) 6331 5006

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World Potato Congress in Durban

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The 3rd World Potato Congress held in Durban, South Africa in March was well attended by over 700 delegates from 33 countries.

The Congress was organised with sponsorship from the major processor companies and focused on current industry developments and new technologies. McCains and Simplot were both represented by their senior executives.

Australia was represented at the conference by a delegation from Western Potatoes, growers from Tasmania and Department of Primary Industries officers from Queensland.

The Congress venue featured display booths which were a show case for the various products and technologies applicable to the potato industry. Technico Pty Limited from Australia, had a manned booth displaying Technituber® Tubers and photographic material.

A field visit to Mr. John Amstrong's farm "Sourveldt" at Rosetta in the KwaZulu-Natal midlands was organised for the last day of the congress to view seed and standard commercial potato production and grading operations.

Packing shed on Mr. John Amstrong's farm "Sourveldt" at Rosetta in the KwaZulu-Natal midlands during visit by conference delegates

The talks

The Director General of the International Potato Centre (CIP), Dr. Hubert Zandstra talked about current world potato production issues. In his opening remarks to the congress, Dr. Zandstra addressed the issue of major disease infestations occurring through the haphazard transfer of seed potatoes from one region or country to another. Tightened regulations, controls and the implementation of tougher phytosanitary inspections for seed potato shipments were raised as key issues to be addressed as a priority by importing countries and regions.

Papers were presented by country, state and regulatory authorities about market reporting, access and improved marketing techniques, production systems - grading and transport, country markets and retail market changes. Western Potatoes presented a paper on future marketing trends.

Processor organisations talked about demand and processing requirements, health and nutrition issues and opportunities in the industry. Several key speakers focused on the health aspects of the processed potatoes, particularly in relation to the total fats and salts in French fries.

Research organisations talked about the benefits of satellite technology, transgenic and biotechnology developments, disease and management systems (late blight as a focus) and carbohydrate issues of processed potatoes. Specific coverage was given to the public perception and the desirability or otherwise of genetic manipulation of potato varieties. The industry will need to address these issues in the very near future.

Talks on the African potato industry included the topics - the structure of the African potato industry, deregulation and market demand, retail market strategies and pre-pack systems, South Africa as the gateway to Africa and reports by various African countries.

Future trends in Africa

Strong growth in production is expected during the latter part of the decade in Egypt, Algeria and Morocco. Yield increases of 30 - 50% are expected in sub-Saharan countries in East and West Africa.

Consumption of potatoes as a food is expected to increase, although per capita consumption may remain stable.

Presentation of award to JR Simplot for lifetime contribution to the Potato Industry

Potatoes should, however, become more important in the diet in densely populated potato producing areas in Eastern, Southern and Central Africa.

The processing sector should experience the fastest growth, especially in North Africa which is well placed for expansion. This also applies to South Africa which would result in a considerable boost for potato production locally.

Some African countries such as Egypt and South Africa are expected to export potatoes. The latter is self sufficient and imports are unlikely. The Uruguay Round Agreement could result in an increase of imports into African countries.

Policy making in many African countries should grant higher priority to the potato as it can play an important role in the whole food system. The potato has great potential for addressing the hunger issue in many African countries. For this to happen farmer associations are needed to represent the individual farmer's interests on a group basis to influence national policy. It is essential that the total potato industry encompassing production, processing, nutrition and environmental concerns are considered in every country.

There is a need for greater attention by breeders for improved and adapted varieties tolerant to high temperatures and capable of producing high yields under short day lengths. Disease resistance of these varieties is of utmost importance as major disease outbreaks (e.g. late blight and bacterial wilt) can disrupt production and cause severe shortages in food supply.

Proceedings may be obtained from the congress organisers -
Potato Producer's Organisation
Private Bag X135 Pretoria 0001
South Africa
☎ 0011 27 012 323 1696
Fax 0015 27 012 325 6102 ■

Crop rotation - an old method of disease control in modern potato production

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The Incas of Peru established mandatory seven-year rotations in potatoes before the arrival of the Spanish.

Modern scientists later discovered that this rotation kept populations of the destructive potato cyst nematode below the numbers that caused economic damage.

Rotations are still practised today but modern potato farmers rely heavily on chemical fertilisers and pesticides to improve yields and to control pests and diseases.

Economic pressure on growers to shorten rotations has renewed the focus on the development of crop rotation systems to provide sustainable production in the major potato regions world-wide.

A project which began last season is studying the influence of rotation on soil-borne diseases of potatoes and examining ways of manipulating rotations to improve disease control and yields. It compliments the project on common scab control in Tasmania.

Good information on the effects of different rotations on diseases and yield will assist in the development of crop management strategies that provide the best yield and quality.

The project involves:

- review of overseas work
- surveying crops to evaluate the relationship between rotations, disease, yield and quality
- trials to see whether including specific brassicas in the rotation affects disease levels
- trials on the management of organic matter to control *Rhizoctonia*
- studies of the role of pastures in maintaining *Rhizoctonia* between potato crops

Review of overseas work

Major long-term research projects (6 years or more) evaluating the effects of cropping frequency and different cropping sequences on production are under way in Europe, Canada and USA.

These studies have clearly shown that short rotations can affect tuber yield, tuber quality and soil condition.

Yield
In the Netherlands, the yield of potatoes was 7% less in a one in six rotation and 20% less in a one in three rotation than in potatoes grown for the first time in new ground.

Quality
In Canada, an unacceptably high proportion of processing tubers are culled at the factory gate because of tuber diseases and poor tuber size and shape when rotations are less than three years.

Soil quality
Canadian research has shown that potatoes return less organic matter to soil (300 kg/ha) than cereals (1500-2500 kg/ha) and grasses (3000-5000 kg/ha). Short rotations can reduce organic matter and soil quality and lead to a greater potential for soil degradation and erosion.

Results also indicate that additional inputs, such as fertilisers, do not compensate for reductions in yield and quality in short rotations.

Can rotations reduce disease

A break between potato crops prevents the excessive build-up of disease populations in soil.

The effect of rotation on a particular disease depends on the life-cycle of the organism causing the disease and its means of survival. The *Rhizoctonia* fungus, survives in organic debris, can actively grow in soil and colonise the roots of many plant species in the period between potato crops. This disease is a good candidate for control through rotation as we can potentially manipulate alternative hosts and organic matter.

In contrast, powdery scab produces spores that can remain dormant in soil for several years. Rotations of five years or more do not appear to control this disease.

Can brassicas in the rotation reduce disease

The effect on disease levels of including particular brassicas in the rotation will be examined in field trials as part of this project. This will extend the biofumigation work of John Matthiessen and his team (see report on biofumigation elsewhere in this magazine).

Controlling weeds helps control diseases

Weed control is critical to the effective management of soil-borne diseases in rotations. Many weeds are hosts of pathogens such as black dot, *Rhizoctonia, Verticillium* and some nematodes. Volunteer potatoes also act as reservoirs for potato diseases between potato crops.

Without effective control of weeds and volunteer potatoes other disease control strategies practised in rotations may be useless.

Integrating management strategies

The challenge for researchers and potato growers is to develop rotations that give the best disease control, tuber yield and quality without having to resort to uneconomically long rotations.

Research shows that rotations are vital to the sustainable cropping of potatoes and indicates that rotations of less that three years are generally not sustainable. There are significant benefits in yield and quality in increasing the break between potato crops.

The benefits of rotations are greatly enhanced by integration with other disease control strategies. These include:

- disease resistant cultivars to help minimise diseases
- good hygiene practices to avoid contamination of seed, new land or of re-introducing diseases into managed fields
- healthly seed
- appropriate cultural and chemical disease control strategies

Acknowledgements This project has been funded by the HRDC.

■

Black nightshade a major weed

MATTHEW SHERRIFF is a Weeds Researcher and
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Black nightshade is the number one weed problem in many potato production areas throughout Australia, particularly Tasmania.

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

This 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.

Previous Serve-Ag research has identified black nightshade as a host of the disease black-dot and it is also believed to be a host of other soil-borne fungi.

In addition to the losses incurred in the current potato crop, black nightshade is a major problem in subsequent vegetable crops, especially beans and peas. Therefore improved control of this weed should lower production costs for following crops.

Current management practice involves the use of a pre-emergent spray, a post emergent spray and/or mechanical cultivation plus one to two sprays at senescence. It is believed that this practice could be reduced to possibly one pre-emergent spray, reducing costs and reducing soil damage.

Over the past year, Serve-Ag Research has conducted a number of field trials in Tasmania concentrating exclusively on management of weeds in potato crops, particularly nightshade. A range of herbicides with different modes of action have been looked at. The results from these trials have been extremely promising, with data being used for registration purposes. The furthest developed of these is the herbicide Command which should be registered by mid 1998.

Further development of these products may also allow growers to alternate their herbicides as an anti-resistance strategy. It is hoped that the commercial use of these products will further enhance weed management in potatoes.

The 1997-98 season will see a substantial increase in size and scope of Serve-Ag Research trials. It is envisaged that trials will be conducted in all major potato production areas throughout Australia, with some already underway in North Queensland and Tasmania.

This will allow the collection of valuable weed control information under a wide range of environmental conditions.

Acknowledgements This project was supported by the HRDC, DuPont, Novartis and FMC.

HRDC ■

Little tuber disorder in Queensland plantings

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Isolated plantings of certified seed (winter 1996) resulted in 100% non-emergence and the development of "little tuber disorder".

Within each case, the symptoms of the problem included seed breakdown, failure of seed to shoot and where seed had shot this shoot developed a little tuber of about 1-2 cm size.

The variety most affected was *Exton,* however there were minor reports with *Sebago, Red la Soda* and *Sequoia.*

What caused it?

The most common causes of this problem are generally physiologically old seed or seed which has been stored in warm conditions and planted into cold soil. However, neither of these explanations was valid in this case.

It is suspected the problem may have been related to the physiological age of the seed and the combined effect of environmental conditions at planting favourable for the disorder (eg. high May rainfall and above average temperature).

Additionally, there is some evidence to suggest the seed was possibly a little "young" as a result of a cold summer in Victoria delaying maturity.

Firstly, the problem was worse in earlier seed batches (late May planting) whilst later plantings of the same batch of seed (2nd week of June) had no emergence problems.

Secondly, seed from one grower failed to emerge whilst a planting of another grower's seed immediately adjacent had 100% emergence. This indicated the problem was more related to the seed than how the commercial crop was grown.

Sets with the disorder were consistently from the apical part of the seed tuber. Under the warm Queensland conditions the seed developed good apical shoots, and I suspect that hormones responsible for tuber growth were still present and the signal was sent for the developing shoot to produce a tuber.

Plant on left shows the shoot has grown out of the original little tuber

Relationship to physiological age of seed

Two types of physiological age are recognised - senile degeneration (seed is too old) and juvenile degeneration (seed is too young).

Work in Europe has suggested this disorder can in some cases be attributed to physiologically young seed but they are unable to identify under what circumstances.

Little potato disorder has been found after planting physiologically young seed stored at 4°C and only four months after harvest. Indeed warm temperatures early in crop growth followed by cool temperatures can induce a strong tuberisation stimulus and when followed with high temperatures results in second tuber growth.

This situation is very similar to the present case, particularly considering that this seed was probably harvested a little immature given the prevailing conditions.

Overcoming the problem

The problem has concerned not only local producers but also seed growers whose seed was affected. DPI has worked closely with seed growers in attempting to resolve this problem.

It is important to mention that these growers have produced seed in a manner no different to how they would normally grow a crop.

Trials in which immature seed were planted have failed to reproduce the same symptoms and it appears the problem occurred as a result of an unusual combination of growing conditions in Victoria and planting conditions in Queensland.

Unfortunately, these types of problems are often transient and difficult to predict and presently there is no way farmers can measure physiological age of potato seed.

The QDPI has been conducting research on the effects of physiological age on potato production. In Queensland where crops are grown using seed which has had a very short dormancy this is an important issue.

Can you help?

If anybody has some further ideas on this problem please contact Stephen Harper at Gatton Research Station. Your comments would be greatly appreciated. ■

Little tubers arising from certified seed when planted early in the season

Technico's TECHNITUBER® tubers

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Technico Pty Limited is an Australian owned horticultural technology company based in the Southern Highlands of New South Wales and owns the TECHNITUBER® technology.

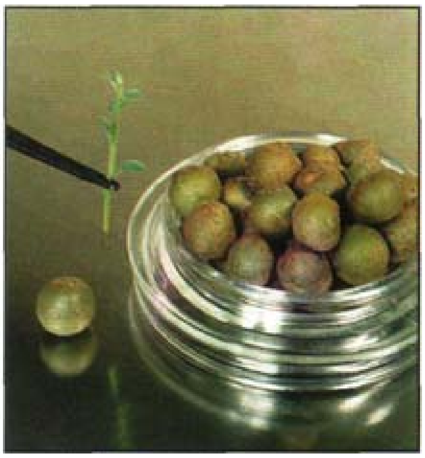
It has developed this new technology for the propagation of low cost certified seed which is produced in two field multiplications compared with the traditional four or five generations of the Certified Seed Potato schemes in Australia.

The TECHNITUBER® tuber technology

Research in the late 1980's identified a method of producing seed potatoes. TECHNITUBER® tubers, are produced from disease tested tissue culture produced in dedicated, environmentally controlled facilities under stringent quality assurance programs.

The TECHNITUBER® technology is set to revolutionise the potato industry by reducing the time required to produce significant volumes of high grade seed material. The process enables the potato industry to rapidly expand the existing seed base in order to meet market requirements and to rapidly introduce new potato breeding lines. The combination of large scale production and low unit cost TECHNITUBER® tubers means commercial quantities of affordable high grade seed potatoes are now possible within two field generations.

TECHNITUBER®Tubers are produced from pathogen tested tissue culture



To assist farmers to better understand the TECHNITUBER® tuber technology, Technico has carried out a major program of demonstration and commercial plantings both in Australia and internationally. In late 1996 TECHNITUBER® tubers were planted by farmers using Technico agronomic recommendations in NSW, Victoria, Tasmania, South Australia and Western Australia. Significant assistance was provided by the Tasmanian Department of Primary Industry and Fisheries, VicSPA and New South Wales Agriculture.

Production from these plantings produced quality, uniform sized seed grade material from both bed and row plantings. Yields in excess of 30 tonnes per hectare of high quality Generation One Seed were achieved from direct field plantings of TECHNITUBER® tubers around Australia.

Using an extended planting season the TECHNITUBER® tuber also demonstrated its ability to produce commercial potatoes with yields of over 50 tonnes per hectare achieved from field plantings of *Kennebec* TECHNITUBER® tubers in Tasmania.

TECHNITUBER® tubers are rapidly achieving national and international recognition as a miniature seed potato capable of achieving reliable field production. The ability of the TECHNITUBER® technology to deliver a seed propagule, pre-conditioned and sprouted for field planting has had a significant impact on uniform field emergence resulting in high field productivity.

The ease and accuracy of planting which has been demonstrated by Technico using a vacuum seeder also heralds a new era for early generation seed potato production.

Future developments

Technico is further expanding its commercial operations both in Australia and internationally by developing certified seed production programs with dedicated seed industry growers. This program is aimed at providing high quality, early generation certified seed for growers supplying the fresh and processing markets.

Field evaluation of *Kennebec* Generation 1 tubers harvested from field plantings of TECHNITUBER® Tubers in Northern Thailand

Technico continues to explore the opportunities for the TECHNITUBER® technology with the recent completion of production facilities in the USA and Mexico further promoting international recognition of the technology. Planning is also well advanced on the construction of a production unit in China for 1998 and early indications suggest that an Indian production unit will not be far behind. ■

G1 production of *Desiree* from field planting of TECHNITUBER® Tubers

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