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Potato breeding study tour
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Dr R Kirkham
Agriculture Victoria

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Potato Breeding Study Tour 1996

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Introduction

This tour allowed me to visit the European Association for Potato Research EAPR Conference and the Potato Association of America PAA Conference. These are the two main potato research conferences in the world and much of the information is directly applicable to Australia.

I was able to visit a number of potato breeding programs and potato research programs in the UK, the Netherlands and the USA. This allowed me to compare methods and techniques used in the NaPIES research program. This also allowed me to identify germplasm useful both directly and indirectly, through the breeding program, for the Australian potato industry.

Itinerary

- European Association for Potato Research (EAPR) Conference
  Veldhoven, the Netherlands

- Hettema Zonen
  Emmeloord, the Netherlands

- Scottish Agricultural Science Agency (SASA)
  East Craigs, Edinburgh, Scotland

- Scottish Crop Research Institute (SCRI)
  Invergowrie, Dundee, Scotland

- Nickerson Seeds,
  Forfar, Angus, Scotland

- Potato Marketing Board Experimental Station (PMB)
  Sutton Bridge, England

- National Institute of Agricultural Botany (NIAB)
  Cambridge, England

- San Luis Valley Research Center, Field Day
  University of Colorado, USA

- Intermountain Research Center, Field Day
  Tulelake, University of California, USA

- University of Idaho, Potato Breeding Program
  Aberdeen, University of Idaho, USA

- National Research Support Project Annual Meeting
  Aberdeen, Idaho, USA

- Potato Association of America (PAA) Conference
  Idaho Falls, Idaho, USA

The European Association for Potato Research (EAPR)) Conference

This was held at Veldhoven in the Netherlands during the 14-19th of July. The conference is held every three years and in 1996 had more than 500 delegates. Lectures were held concurrently at five locations and covered a wide range of topics. Dominant themes were genetic engineering and molecular markers and also *Phytophthora infestans* .

Some of the more interesting papers included:

- "Survival of *Pseudomonas solanacearum* in cool climates" by Elphinstone, Central Science Laboratory, England.

  Bacterial Wilt was found in seed potato crops in the Netherlands last season and it's spread in Europe has been linked to bacterial infection of the native weed *S, dulcamara* lining irrigation channels. Existing European Community legislation aims to quarantine and eradicate the organism. This will be difficult due to problems with detection methods of latent infection of the bacterium in potato tubers. This disease has particular implications for the Dutch seed potato industry which is about one million tonnes (similar to the total Australian potato production) of which 75% is exported to more than fifty countries.

- "Current position and problem with Potato Cyst Nematode in the UK" by Hancock, ADAS, England.

  Soil surveys show that 42% of ware potato land is infested with PCN and 40% of growers tested had PCN. Preplanting soil tests of Scottish seed growers resulted in 4% positive tests (these paddocks cannot be planted for seed). The original PCN population was mainly *Globodera rostochiensis* but studies in 1995 showed 5% Ro, 54% *G. pallida* and 41% mixed species. This has occurred due to widespread use of Ro resistant varieties. Ware potato production in the UK has 3-5 years rotation without potatoes, 18% use of granular nematicides and an increasing use of soil fumigation in attempts to control PCN.

Hettema Zonen,
Emmeloord, the Netherlands
Dr John Van Loon Director

Potatoes are the most valuable arable crop grown in the Netherlands. In 1995 almost 180,000 hectares of seed, ware and starch potatoes were grown. This accounts for almost 10% of all agricultural land and more than 30% of all arable land in the Netherlands. Production during 1994 was 3.4 million tonnes of which 60% was processed and most was exported. The Netherlands is the second largest country after Germany in production of potato starch. Production of seed during 1994 was over 740,000 tonnes of which 75% was exported mainly to European Economic Community Countries and to Africa. Main varieties grown are Bintje, Spunta, Desiree and Agria.

Hettema is one of the three large Dutch seed companies along with Agrico and ZPC. In addition to a large potato breeding program the company contracts the production of 175,000 tonnes of seed potatoes for sale mainly to Mediterranean and middle east countries. Although the breeding program is based in Holland the company has an extensive variety trial program testing new varieties in those countries. During the meeting with Hettema I visited one of their contract seed growers in the NE Polder reclaimed from the sea in the 1940's. The grower did not irrigate and slashed tops at 85-90 days to avoid aphid flights . Yield's were quoted at up to 45t/ha seed grade and land cost 50,000 Guilders (A$ 37,000) per hectare. Rotation is potatoes one year in four with other crops mainly winter wheat and sugar beet. During the season, the seed crop is sprayed 2-4 times for aphids and 7 times for late blight. His ware crop was sprayed 13 times. Gross prices averaged over the past three years which had been received by the grower were 500 guilders ($A 385) per tonne for seed and 300 Guilders ($A230) per tonne for ware.

Both Hettema and ZPC have recently imported a number of varieties into Australia which will be protected under Plant Breeders Rights legislation in Australia. The NaPIES program will test some of these varieties in trials in production areas.

Scottish Agriculture Science Agency, East Craigs,
Edinburgh, Scotland
Dr Stewart Carnegie, Head of potato section
Ms Sandra Goodfellow, Technician tissue culture
Mr Harry Dickinson, Registration and certification, tissue culture, potato collection.

SASA maintains a large collection of potato varieties for the seed industry and is the quarantine station for importing potatoes into the UK. More than 500 varieties are maintained as pathogen tested *in vitro* and additional varieties are maintained in the field. This is the main mother stock for all Scottish seed and the largest tissue culture collection of potato cultivars in the UK. This laboratory used to produce minitubers for nuclear stock but recently closed and now produces about 100,000 plantlets only per year. There are nine accredited minituber producers in the UK seed potato program. More than 60,000 tonnes of certified seed are grown in England and more than 450,000 tonnes of basic or early generation seed grown in Scotland. Minitubers from tissue culture laboratories are tested for trueness to type by growing samples of ten tubers for each variety in the field at East Craigs.

The large collection of varieties maintained in tissue culture at SASA has been the main source of varieties imported into Australia from Europe.

The seed inspection service headquarters is at SASA which uses up to 150 inspectors at critical periods during the growing season. East Craigs have variety plots and diseased plant plots for training inspectors. Variety trials are also grown to determine district, uniform and stable (DUS) characters to allow Plant Breeders Rights registration and for value for cultivation and use (VCU) to allow varieties to be included on the UK national list to allow marketing as certified seed.

Scottish Crop Research Institute
Invergowrie, Dundee, Scotland
Dr John Bradshaw, Potato Geneticist
Dr Finlay Dale, Potato Geneticist
Mrs Helen Stewart, Plant Pathologist

The Scottish potato breeding program was shifted to Dundee in 1981 from East Craigs and Pentlandfield. Main areas of work now include studies on inheritance, breeding methods and variety selection. Since 1987 selection of finished cultivars is done with commercial networks. At the moment there is a joint agreement with Nickerson seeds and Greenvale Produce (formally Dalgety Produce) where they take 40 advanced selections annually and test these in 4 trials in the UK. In subsequent years lines are retested in the UK and also tested in Spain and Israel. The potato genetics program employs 25 people and 50% of the total research effort at SCRI is on potatoes. Projects within the potato genetics program include maintenance of the Commonwealth potato collection, a diploid breeding program, molecular marker studies, transgenic studies and disease resistance breeding.

In the breeding program disease resistance has a high priority particularly for PCN (pallida and rostochiensis) and Late Blight (foliage and tuber) . Other diseases include Common Scab, Powdery Scab, Blackleg, Gangrene and Silver Scurf. The breeding program grows about 100,000 seedlings each year in the glasshouse from which 40,000 are selected to be grown in the field. In the third field generation 1000 breeders lines are tested in replicated trials. Although the major emphasis in this program is on disease and pest resistance there is some selection for yield and quality in later trials. The breeding program uses a system its researchers have developed of progeny testing 200 different crosses to select 40 main crosses used in the next year to produce the 100,000 seedlings annually. The 200 pedigree seedling populations are assessed by taking small samples, usually 50 seedlings, and testing for reaction to Late Blight in foliage, Late Blight in tubers, PCN (pallida), specific gravity, fry colour after 10^0C and after 4^0C storage and tuber appearance.

SCRI uses a simple test to select for varieties resistant to Silver Scurf which could be incorporated into the Australian program. Silver scurf is cultured from potato skin and grown on potato dextrose agar. This is in then macerated with water and tubers to be tested are dipped in the mixture before incubation at high temperature and relative humidity.

The test used to select for Powdery Scab resistance is similar to that used in the past by the Australian program. An inoculated field site is used which is irrigated heavily and regularly to promote disease development.

Nickerson Seeds
Forfar, Scotland
Dr David Coombs
Technical Manager, Potatoes

Nickerson Seeds has been owned by Limagrain since 1979 and is mainly involved in cereal breeding and sales. Nickersons sell 40,000 tonnes of seed annually of which 10,000t is grown in the Netherlands and 30,000t is grown in Scotland. Nickersons themselves grow 8,000 tonnes of potato seed. Of the 40,000 tonnes of seed sold, only 25% is of non protected varieties (varieties not registered for Plant Breeders Rights). Nickersons cannot sell Dutch owned or protected varieties overseas and are therefore breeding and testing other varieties in Mediterranean countries.

AgVictoria and Nickersons have had a five year agreement to test Australian varieties in Europe that finished in August 1996. During this period a limited number of Australian bred varieties and breeders lines have been tested and Snow Gem has performed well in the two years of field trials in Spain. Nickersons have sent the line 14981AC8 (since named Spey) to Australia to be tested by NaPIES and I am in the process of importing other varieties for the fresh market and for French fry processing.

Nickersons have agreements with both Agrico and ZPC and the main varieties sold in the UK by Nickersons are Estima, Marfona, Wilja and Romano. Nickersons have a tissue culture laboratory at Forfar which produced 600,000 minitubers and 20,000 plantlets in 1996 and has a capacity of one million minitubers per year. Price per minituber ranges from 20 p to £1 (40c to $A2) with most at 40 p. This material is nuclear stock for the seed scheme in the UK where it is grown by the VTSC (Virus Tested Stem Cutting) Elite seed growers for 2 years and then Certified seed growers for 2-6 years, mainly 4 years. Half of the nuclear stock produced by Nickersons is under contract with United Biscuits.

Because Nickersons would like to export more seed but are not allowed to export protected Dutch varieties they are interested in testing varieties that they will be able to licence. In addition to testing advanced lines from the SCRI program and some imported lines from the NaPIES program, Nickersons also contract SCRI to produce early generation breeders lines of specific pedigrees. Nickersons have a fairly large variety testing program with initial trials and seed grown at Forfar, some advanced trials in the UK and limited trials in Mediterranean countries, mainly Spain, contracted through Agrolon. Although initial trials test for some disease resistances, particularly Common and Powdery Scab, Blackleg and Gangrene the main emphásis is on skin type suitable for washing and improved eating quality with boiling and baking tests and crisp tests after storage at 8^0C and 4^0C.

Potato Marketing Board Experiment Station
Sutton Bridge, England
Dr Adrian Cunnington
Manager Research and Development

The UK industry produces 6 million tonnes of potatoes of which 3.5 million tonnes is stored. There has been a slight decline in consumption of fresh potatoes during the past 2 years due to high prices associated with dry years. Consumption of potatoes in the UK is much higher than Australia with 64kg fresh and 42kg processed, (mainly as French fries which is increasing), making a total of 106kg/head (c/f Australia 55kg). About 33% of the ware market is washed and this is increasing. Some potatoes are washed and dusted with a black peat soil before sale.

The main potato varieties grown in the UK during 1995 in hectares;

- ware: Maris Piper 23,000, Estima 16,500, Cara 9,000, Nadine 6,500 (increasing), Desiree 4,500, and Romano 3,800.
- crisps: Record 8,500,
- French Fries: Pentland Dell 7,800.

The UK exports (tonnes) during 94/95 were 220,000 ware, 42,000 seed, 78,000 processed (fresh. tonnes equivalent). Imports into the UK during the same period were 45,000 ware (mainly new potatoes), 700,000 processed (Fresh equivalent) mainly as frozen French fries.

The Potato Marketing Board, PMB, imposes an area or quota fee which is licensed at £40/hectare (A$80) and above quota fees are at 10 times the quota. The PMB has a scheme of market intervention and will support the market price if it falls below a minimum value. The PMB has a budget of £2 million each for promotion and for R & D and also supports some groups concerned with market information.

About 80% of the potato R&D supported by the PMB is for projects contracted outside the PMB. The 20% internal projects are for those at Sutton Bridge which in the future will also be contracted and Sutton Bridge Experimental Unit will no longer be fully funded by the PMB.

The R&D at Sutton Bridge is the storage work funded by the PMB and consists of,

- Storage management and trials of varieties in storage
- Processing quality and physiology
- Plant pathology in storage

In June 1997 the PMB will become the Potato Industry Council with a fixed levy on all area planted. This levy will also include packers and processors. During 1996 there has been no quota and areas have increased slightly from 142,000 hectares to 146,000. The PMB has been doing some work on CIPC replacements particularly Carvone. The European Community want a 5ppm maximum CIPC residue whereas the UK want 10ppm. Cunnington anticipates problems with a 5ppm MRL for CIPC due to uneven distribution in storage but thinks the cost of Carvone (likely to be ten times that of CIPC) will be prohibitive.

National Institute of Agricultural Botany, NIAB

Cambridge, England

Mr Tom Dixon

Head of Potato and Sugar Beet Section

Mr Paul Gans

Potato Pathology and Seed Health

NIAB is an independent Institute involved in training, research and development, quality assurance and testing functions for a range of crops. NIAB has programs of variety testing for Plant Breeders Rights and for accession to the National List of Plant Varieties.

Six years ago NIAB was funded entirely by MAF, the Ministry of Agriculture and Fisheries, but this now accounts for 10% with the remainder from the Potato Marketing Board R&D levy and contract research.

The main work on potatoes is contract testing to determine distinct, uniform and stable (DUS) characters to allow Plant Breeders Rights registration and value for cultivation and use (VCU) to allow varieties to be included on the UK National List or the EC Common Catalogue. Varieties must be on the National List (approximately 150 cultivars) or Common Catalogue (approximately 350 cultivars) to allow marketing as certified seed. DUS tests are based on a trial at one site and VCU tests involve yield trials at two sites, various major disease resistance tests and quality tests including damage resistance.

In the UK the commission received on seed sales of protected potato varieties is usually higher than the royalty payment and PBR is being used by processing companies to protect exclusive varieties. The Scottish Crop Research Institute program recently released the salad fresh market variety Anya, derived from a cross with Pink Fir Apple, exclusively to the Whitworth Potato Packing Company.

Last year the Potato Marketing Board reviewed its priorities for research spending and variety testing was given a high priority. The PMB has increased funding to NIAB for trials in order to provide more information on how growers husbandry can be tailored to fully exploit the advantages of new potato varieties. The other major contract work on potatoes done at NIAB is routine virus testing of potato seed using ELISA.

San Luis Valley Research Center
University of Colorado, USA
Dr Dave Holm, Potato Breeder
Dr Rick Zink, Extension Potato Specialist

The San Luis Valley is a large intermountain valley with an elevation of 2,500 metres and latitude similar to southern Australia's potato production areas. The valley grows 31,000 hectares of potatoes and more than 90% of Colorado's total production. All the potato production in Colorado is under irrigation with almost 3,000 center pivot systems in that State. Production of potatoes is increasing and has increased 10% on average each year for the past 25 years. Almost all potatoes grown are for the fresh market and main varieties are Russet Nugget, Russet Norkotah, Centennial Russet, Russet Burbank and Sangre.

Dr Dave Holm has operated a large potato breeding program in Colorado since 1978. The program grows 40,000 seedlings in glasshouses each year and exchanges material from plants which produce more than one tuber with programs in Idaho, North Dakota, Texas and Alberta.

The Colorado program grows 80,000 seedlings in the field in the first year. (cf 20,000 seedlings in the Australian program). This program has a very high selection pressure as shown by the flow chart:

Field	Year	1	,	80,000	genotypes	as	single hill
"	"	2	,	800	"	"	12 plants
"	"	3	,	200	"	"	24 plants
"	"	4	,	50	"	"	36 plants
"	"	5	,	25	"	"	2 rep x 25 plants

Crops are grown with minimal spray protection to select for field resistance to Target Spot and samples from field year 3 onwards are tested for specific gravity and processing quality. In year 6, selected breeders lines are added to trials testing past years selections and in year 7, selected lines are added to the Western Regional Trials

which has trials at more than 10 locations each year including Idaho, Washington, Oregon, California, Colorado, New Mexico and Texas.

Results from the latter 4 states are most pertinent as some of their production areas are similar to southern Australia.

The Colorado program targets mainly russet skin varieties suitable for fresh market or/and French fry processing and has smaller efforts in crisp varieties and red-skinned varieties. The program has had some success and Sangre and Russet Nugget which were bred by Holm are major varieties in Colorado.

The Colorado program maintains a large collection of varieties as pathogen tested tissue cultures. This collection has breeders lines and varieties from all programs in the USA and Canada as well as breeders lines at advanced selection stage from Holm's program.

Ag Canada until recently maintained a large tissue culture collection of potato varieties at Fredericton, Vancouver, British Columbia. This collection had been extensively used in the past to supply many varieties imported into Australia. Ag Canada will no longer maintain this collection and a much reduced collection is to be maintained by private industry. In the future the extensive collection at Colorado will be the main source of American germplasm imported into Australia.

Germplasm:
Red skin fresh
C 086142-3 ⟩ both performed well in
C 086218-2 ⟩ trials in California
DT 6063-1R
ND TX 302-1

French fry
AC 83064-6
CO 87009-4
ATX 85404-8
BC 0894-2
AC 78069-17
A 79141-3

Intermountain Research Center

Tulelake, California, USA

Dr Ron Voss, Potato Extension Specialist

California grows approximately 20,000 hectares of potatoes of which 50% is in Kern County (Bakersfield) grown mainly under solid set irrigation in sandy soils and 25% is in Tulelake on mixed soil types. In Kern county about 2,000 hectares are planted with growers 'kept seed' using "double planting" in the one season. About 5% of production is for seed, 15% for crisps and 80% for fresh. All fresh market potatoes are washed with fairly even production of reds, russets and long whites.

Main varieties are White Rose, Tejon, Calwhite, Red La Soda, and Dark Red Norland. Areas in California are harvesting potatoes virtually all year round. Kern county plants from late Autumn through Winter into Spring for harvesting late Spring and early Summer. There is also some planting during mid Summer using either saved seed (40%) or certified seed from a suitable production area (60%).

Problems of dormancy are mainly overcome by harvesting early, quickly cool storing for 2-3 weeks at 3^0C and then at ambient temperature. Gibberellic acid is not used commercially as it has caused long and misshapen tubers in the crop.

The disease Powdery Scab has become less of a problem with the increased use of soil fumigation with metham sodium over the past 5 years. About 20% of all potato crops in Kern county are planted into fumigated soil. Common crops grown in rotation with potatoes are cotton, carrots, onions, tomatoes and wheat.

Dr Ron Voss is a potato extension specialist based at the University of California at Davis and spends 1/3 of his time directly on potato research mainly in variety testing. Voss receives a total of 300 breeders lines annually from a number of sources. Some lines have been selected for 2 years and other have been selected for 6-7 years. Main breeding programs supplying lines are Idaho, Colorado, North Dakota, Washington

and Texas. Recently the Dutch seed companies Hettema and Agrico have supplied selected varieties for trials.

Californian variety trials usually have 4 replications and commercial trials have plots which are 4 rows. Voss has incorporated a damage test to select against blackspot bruising in new varieties and tests for crisp quality by core boring samples of varieties which are then tested in processing factories.

Results from Voss's trials are included in Western Regional Trials edited by Dr Steve Love at Idaho and in abbreviated form in the National Potato Germplasm Enhancement Report edited by Dr Kathy Haynes, Maryland, USA.

Germplasm
French fry russet types:
AO 85165-1
A 84118-3
AC 83064-6
A 89384-10

long whites:
Calwhite
Tejon
AD 74548-5
AD 8487-1

Reds:
DT 6063-IR (Cherry Red)
AD 82706-2
NDO 2438-7
NDO 4232-IR

Boutique:
Ruby Crescent
Banana
Butterball
Yellow Finn

University of Idaho, Agricultural Experiment Station
Aberdeen, Idaho, USA
Dr Joe Pavek, Potato Breeder
Dr Dennis Corsini, Potato Pathologist
Dr Steve Slack, Research Horticulturist

Idaho grows 160,000 hectares of potatoes annually to produce 6.5 million tonnes or more than one third of the total potato crop in the USA. Idaho grows 20,000 hectares of seed and is the main seed producing state. About 60% of Idaho's production is processed, 50% into French fries and 10% dehydrated, 40% sold fresh, mainly as long russets, and less than 2% processed into crisps.

The main variety grown is Russet Burbank which is declining with increases in Shepody and Ranger Russet. Soils are mostly alkaline with pH usually 8. Idaho has winters which freeze soil with heavy snow falls, however, there is little rainfall with totals around 8 inches per year.

The Idaho breeding program targets 80% French fries, or dual purpose French fry and fresh type, 15% crisps and 5% germplasm or parent lines. The breeding program grows 110,000 seedlings each year in glasshouses and selects the largest tuber to be grown by the Idaho program. Smaller tubers from the same plants are sent to breeding and selection programs in Oregon, Colorado, North Dakota and Texas. The Idaho breeding program grows more than 100,000 seedlings in the field in the first year as single hills at one metre spacing. There is an extremely high selection pressure in the first year based mainly on tuber appearance and only 2,000 selections are grown in the second year as 12 hill short rows. These 2,000 selections are tested for specific gravity, fry colour, glycoalkaloid content and reaction to bruising and 200 lines are selected for further testing in replicated trials at two sites in Idaho.

These trials included tests of fry quality after storage at 10^0C, 7^0C and 4^0C with fry tests direct from 4^0C and after 2 weeks reconditioning at 15^0C. Lines are also tested again for bruise reaction by an abrasive peel test at 2^0C.

The main early generation disease testing is for the early dying diseases, Early Blight, Verticillium Wilt and Common Scab using a non inoculated field test. In later generations, lines are tested in inoculated tests for reaction to Fusaruim Rot, Erwinia Rot and Late Blight.

After a total of 7 years testing in Idaho, advanced lines are entered into the Tri-State trials while also being multiplied for seed to be passed over to seed growers. The Tri-State trials test varieties at 10 locations over Idaho, Washington and Oregon.

The University of Idaho Nuclear Seed Potato Project maintains a small collection of germplasm in tissue culture comprising 33 named varieties and 17 breeders lines. Advanced breeders lines are regularly being added and removed from the list depending on their performance in trials. Advanced breeders lines which perform well in trials in Idaho would be available from this collection.

Germplasm

French Fry:
A 82360-7
A 84420-5
A 84118-3
A 84180-8
A 8787-2
A 8792-1

Red:
A 82705-1R
A0 82706-2R

National Research Support Project (NRSP) Annual Meeting 1996
Aberdeen, Idaho, USA

The NRSP has responsibilities in directing and funding the collection, maintenance and research of wild potato species germplasm.

Present at the 1996 meeting were:

- John Bamberg, Max Martin and David Spooner from the Potato Introduction Station, Sturgeon Bay, Wisconsin. This group is responsible for collecting wild species and maintenance of the national collection at Wisconsin.

- Florian Lauer (Minnesota), Joe Pavek (Idaho), Dennis Corsini (Idaho), Al Reeves (Maine), Al Mosley (Oregon), and Creighton Miller (Texas), from potato breeding/evaluation programs in the USA.

- Allan Stoner and Suzanne Hurtt from USA quarantine.

I was able to take part in the meeting as a visitor which I found invaluable as the meeting discussed the current status of potato breeding programs across the USA.

A recent survey of the 13 potato breeding programs in the USA by the NRSP showed the top two priorities overall were Late Blight resistance and the ability to process after low temperature storage or 'cold chipping'. Other major priorities were resistance to Early Blight, Erwinia, Common Scab and Colorado Potato Beetle.

The Potato Association of America (PAA) Conference

This was held in Idaho during the 11-16th of August. The conference is held annually and had almost 400 delegates. Lectures were held concurrently at 3 locations and included a general symposium on plant biotechnology and its impact on the American potato industry.

Some of the more interesting papers included:

- "Monitoring evolving populations of *Phytophthora infestans* causing Late Blight of potato in Canada" by Peters *et al,* Ag Canada, Prince Edward Island

  Studies of *P. infestans* in Canada showed that prior to 1989 the only strain present was the A1 mating strain that was susceptible to metalaxyl (Ridomil). In 1989 an A1 strain resistant to metalaxyl was found and there were increasing problems with Late Blight disease. In 1994 both A1 and the more virulent A2 mating strains were found in Canada with the ability to reproduce sexually to form overwintering oospores and potentially more virulent recombinant strains.

- The Future; What is yet to come and how might it impact on the potato industry. by Keyes, NatureMark Potatoes, Idaho, USA

  NatureMark Potatoes, which is part of the company Monsanto, is using gene transfer to develop disease resistant varieties which are then marketed under the Newleaf brand. Russet Burbank, Atlantic, Shepody and Superior are the varieties being developed and genes already included give resistance to PVY, PLRV, Colorado Potato Beetle and give high dry matter content. The company anticipates resistance to Verticillium, Late Blight and Early Blight will be included after about 4 years research. This season there are 92 seed growers across the USA growing Newleaf potatoes and there are 5,000 hectares of Newleaf Russet Burbank, with the Bt gene, being grown as commercial crops. In recent marketing tests in Canada Newleaf potatoes were advertised as being genetically altered but environmentally friendly due to less insecticide protection and out sold other potatoes during the test period.

Importing Germplasm for Testing in Australia

- **Europe**

ZPC and Hettema from the Netherlands and Caithness and PBI (Plant Breeders International) from the United Kingdom have or are in the process of establishing licensees for their varieties in Australia and have sent varieties to Australia to be tested or marketed under various arrangements. The other main Dutch seed company Agrico may also establish a licensee in Australia. All these companies will only export advanced breeders lines or recently released varieties that can be protected by Plant Breeders Rights in Australia and a number of European varieties have recently been protected by PBR in Australia prior to trialling or commercialisation.

The cost of importing and protecting varieties in Australia is high and the Australian industry is small with national certified seed sales of just over 50,000 tonnes. The industry in Australia is diverse with a large and increasing number of varieties being grown and certain market requirements, particularly bright white tuber skin for washing, that are practically unique to this country. I think these factors in combination will mean less involvement from European breeders and seed companies in the long term.

The company Nickersons takes advanced lines from the SCRI breeding program as well as commissioning some contract breeding and is targeting washed potatoes to be grown in Mediterranean countries. I am making arrangements with Nickersons to import some advanced lines which will be tested in trials in Australia.

- **North America**

In the USA most varieties released from breeding programs located at universities will be protected under PBR and while varieties from United States Department of Agriculture (USDA) are being released as free varieties at the moment this will almost certainly change in the future. Varieties released from breeding programs in Ag Canada are being released under PBR protection.

Although there is a large breeding effort across North America this is generally aimed at French fry processing or long russets for fresh use. Only a few programs have any effort in round white potatoes that are suitable for washing. These include New York, Maine, Michigan and Maryland and some of the Canadian programs. Few breeding programs are using boiling tests in their potato selection programs and it is a low priority selection criterion.

Potato breeding in North America is almost all in Canada and the Northern USA, selecting varieties for either processing or fresh use, which will be grown over a summer with long days and stored during winter. The only potato variety breeding program in Southern USA is in Texas. After a period in recess, North Carolina is about to resurrect potato breeding and variety development programs. The Texas program grows more than 50,000 seedlings each year and mainly selects early maturing long russet potatoes. The Texas potato breeder Dr Creighton Miller has a variety testing and seed increase program in the San Luis Valley, Colorado in collaboration with Dr Dave Holm. The large collection of tissue cultured potato varieties in Colorado includes advanced lines from the Texas program.
The tissue cultured potato variety collections held at Colorado and Idaho are the main sources of varieties for French fry and for red skin fresh market testing in Australia. In general white skin fresh market varieties will have to be imported from other sources. I have arranged to import 5 white skin fresh market varieties/breeders lines from the Maine program in November 1996.

During this visit I discussed the option of importing botanical seed from potato programs in North America. However none of the breeding programs were confident of supplying seed free of Potato Spindle Tuber Viroid (PSTV) or could meet the Australian quarantine requirement of supplying seed from plants that had been tested negative for PSTV and been grown in insect-screened conditions.

Testing NaPIES Varieties Overseas

Until recently Agriculture Victoria had a testing agreement where a limited number of Australian bred varieties and breeders lines were tested overseas by Nickersons. Although Nickersons are eager to develop varieties which they can grow for seed in the UK and export into Europe, they have only a limited variety testing program in Mediterranean climate countries where it is expected Australian varieties will be most suited. A number of European companies involved in marketing seed potatoes approached me about testing Australian varieties particularly in their export market countries. The Dutch company ZPC is the second largest producer of seed potatoes after Agrico and has a network of variety trials in Europe. Crop and Food, New Zealand, have a agreement with ZPC to test NZ varieties in Europe.

I recommend that AgVictoria establish an exclusive agreement with ZPC to test, develop and market Australian bred potato lines suitable for fresh market or for crisp processing.

McCain are the largest processor of French fry potatoes in the world. McCain process 75% of the French fries in Canada, 15% of the French fries in the USA and 25% of all French fries world wide. McCain have an established seed and variety testing program and a scientist responsible for variety testing world wide. McCain have asked for Australian bred lines to test in their trials overseas.

Summary

During this tour I visited potato breeding and variety testing programs in the Netherlands, Scotland, England and the United States of America.

I was able to compare techniques and research methods used in the NaPIES program with those used overseas. All the breeding programs visited were much larger than the Australian program and tested varieties in a number of trials located in targeted production areas.

Despite different growing conditions and variety requirements to the Australian potato industry, NaPIES can exploit the large resources of potato breeding programs overseas particularly resistance to diseases such as Silver Scurf, Late Blight and Early Dying Syndrome as well as improved quality characters such as 'cold chipping' processing. I have identified germplasm useful both directly and indirectly, through the breeding program, for the Australian potato industry and have arranged the importation of some of this material.

Many overseas potato seed companies are interested in testing Australian bred varieties particularly in Mediterranean climate countries. I have recommended the two companies ZPC and McCain be given agreements to test Australian bred varieties.

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