Horticulture Innovation Australia

Final Report

ASDS8 – conference support for vegetable specialists

Dr Calum Wilson
Tasmanian Institute of Agriculture (TIA) - University of Tas

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VG14700

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The 8th Australasian Soil-borne Diseases Symposium (8ASDS) was held in Hobart 10-13th November 2014. This is one of the premier meetings for scientists working with soil-borne disease, soil microbial ecology and plant-microbe interactions in Australasia. The conference attracted 85 scientists and other attendees from seven countries with research students networking strongly encouraged. The scientific programme encompassed topics including pesticides and soil amendments, integrated pest management, plant-pathogen interactions, biological control and disease suppression, resistance, pathogen ecology and epidemiology, and diagnostics and risk management.

Two international specialists in vegetable soil-borne disease R,D&E (Dr Alison Lees, The James Hutton Institute, UK; and Dr Krishna Subbarao, University of California, Davis, USA) were supported to attend the conference. They presented keynote addresses and participated in an industry workshop in NW Tasmania following the conference where they presented to an industry audience.

The ASDS8 meeting provided an important opportunity for scientists to share their latest results and thoughts, network and develop collaborations that will aid in the development of more efficient and effective R,D&E in the future. The industry workshop enabled industry to learn from the experiences of our international specialists in a non-academic setting providing time for questions and informal discussions.

TECHNICAL SUMMARY

The 8th Australasian Soil-borne Diseases Symposium (8ASDS) was held in Hobart 10-13th November 2014. This is one of the premier meetings for scientists working with soil-borne disease, soil microbial ecology and plant-microbe interactions in Australasia. The conference was opened by Tasmanian Liberal MP for Lyons, Mark Shelton and attracted 85 scientists and other attendees. This included participants from Australia, New Zealand, USA, UK, the Netherlands, Brazil, Tunisia, and Malaysia. A good contingent of research students were in attendance with opportunities for networking encouraged. The scientific programme encompassed topics including pesticides and soil amendments, integrated pest management, plant-pathogen interactions, biological control and disease suppression, resistance, pathogen ecology and epidemiology, and diagnostics and risk management.

The HIA grant was primarily used to bring two international specialists in vegetable soil-borne disease R,D&E to the conference. They presented keynote addresses at the conference and participated in an industry workshop in NW Tasmania (at the Forthside Vegetable Research Farm) following the conference where they presented to an industry audience.

The invited speakers were:

Dr Alison Lees (The James Hutton Institute, UK) - a specialists in molecular detection of soil-borne pathogens and development of markers for host resistance selection, who discussed the successes and failures of real-time PCR diagnostic assays as both a research tool and as a predictive tool for soil-borne diseases of potato

Dr Krishna Subbarao (University of California, Davis, USA) - specialist in ecology, epidemiology and integrated control of fungal diseases of vegetables, who discussed how consumer demand (human activities) can alter soil borne diseases, as illustrated with ongoing studies on *Sclerotinia sclerotiorum* and *Verticillium dahliae*.

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ASDS8 CONFERENCE AND ASSOCIATED INDUSTRY WORKSHOP

INTRODUCTION

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The HIA project had the following aims:

1. Assist in facilitating running of the ASDS8 conference.
2. Provide resources to invite two keynote speakers (experts in vegetable pathology) from the UK and the USA to the meetings.
3. Support an industry session where keynote speakers will present to an industry audience.
4. Support a prize for the best student presentation.

The HIA grant was used to bring two international specialists in vegetable soil-borne disease R, D & E to the conference. They presented keynote addresses at the conference and participated in an industry workshop in NW Tasmania (at the Forthside Vegetable Research Farm) following the conference where they presented to an industry audience.

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The ASDS8 meeting provided an important opportunity for scientists to share their latest results and thoughts, network and develop collaborations that will aid in the development of more efficient and effective R, D&E in the future.

Quality student presentations were delivered throughout the conference. Natalia Cripps-Guazzone (Lincoln, University, New Zealand) was awarded a prize of $200 for best student presentation.

Immediately following the conference an industry workshop was held which enabled vegetable industry members to learn from the experiences of our international specialists in a non-academic setting providing time for questions and informal discussions.

ASDS8 CONFERENCE

The ASDS8 meeting provided an important opportunity for scientists to share their latest results and thoughts, network and develop collaborations that will aid in the development of more efficient and effective R, D&E in the future (Fig 1.).

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Student prize:

Quality student presentations were delivered throughout the conference. Natalia Cripps-Guazzone (Lincoln, University, New Zealand) was awarded a prize of $200 for best student presentation.

Table 1: the ASDS8 conference program with presentation titles and authors

SESSION 1 - PESTICIDES AND SOIL AMENDMENTS

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Fig 1: Group photo from the 8th Australasian Soilborne Diseases Symposium (8ASDS), November 2014 at The Hobart Function and Conference Centre Tasmania, Australia

INDUSTRY WORKSHOP

The industry workshop was held on the morning of Friday 14th November at the Forthside Vegetable research Farm (Fig 2.).

Presentations were given by the two international speakers to an audience of around 30-40 industry representatives.

The presentations were followed with a question session, and then lunch provided during which further interaction with the international guests was encouraged. Prof Subbarao was interviewed by AUSVEG representatives and featured within the following Vegetable Australia magazine highlighting his work managing *Verticullium dahliae* and *Sclerotinia* in brassica and lettuce crops, in particular about how changing farm management systems has altered disease incidence.

Vegetable growers' workshop

14th November 10.00 AM

A workshop for vegetable growers and industry will be hosted by the Tasmanian Institute of Agriculture (TIA) at Forthside Vegetable Research Facility, 125 Forthside Rd, Forth, TAS.

The workshop will feature discussions about diseases relevant to local growers and will include presentations from Alison Lees from the Hutton Institute in the UK and Krishna Subbarao from University of California – Davis. The workshop will include formal presentations and open discussions with the international speakers and other TIA plant pathologists (Dr Calum Wilson).

Dr Alison Lees: a plant pathologist will discuss diagnosis and management of soil-borne potato and vegetable diseases, based on her experience in the UK.

Dr Krishna Subbarao: an extension plant pathologist will talk briefly about vegetables in coastal California and then on 'Mechanisms of Broccoli-mediated soilborne pathogen and disease suppression in vegetable cropping systems'.

A short farm walk looking at some of TIA's latest research projects is also included.

The workshop runs from 10:00am and finishes with a free lunch at 12:30pm (no need to RSVP).

For more information please contact Robert Tegg via email on Robert.Tegg@utas.edu.au.

The workshop is part of a HAL supported project funded through the National Vegetable Levy.

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HAL Horticulture Australia

Fig 2: Invitation letter to Industry Workshop

A copy of slides of these two presentations are provided here.

Dr Alison Lee's Presentation at Industry Workshop

Potato (& veg) diseases: UK research

Alison Lees & Jennie Brierley, JHI.

The Scottish Government
Riaghaltas na h-Alba

POTATO COUNCIL

The James Hutton Institute

Our sites

Craigiebuckler, Aberdeen
Laboratories

Invergowrie, Dundee
Laboratories, glasshouses and arable land

Hartwood Research Station, Lanarkshire
350ha rotational and permanent grassland, moor and woodland

Glensaugh, Kincardineshire
865ha rotational grassland, permanent pasture, heather moor and peat

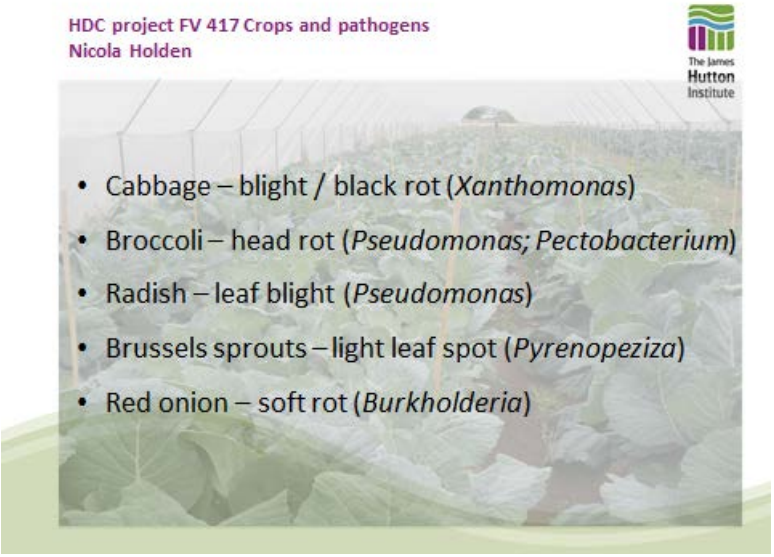
Balruddery Farm, Angus
Arable farm
Centre for Sustainable Cropping

UK vegetable sector

The James Hutton Institute

- UK Field Vegetable sector valued at ~ £690 million. Covers > 130,000 ha, contributes > 30% of the total levy income.
- Primary R&D focus has been crop protection (75% of the research budget).

1. Availability of adequate and sustainable **crop protection measures.**
   - EAMU (formerly SOLA) programme of paramount importance. Maintain anti-resistance strategies. New chemistry, non-chemical approaches, towards pesticide-free produce.
2. Increasing returns on investment through the **efficient use of resources**
   - Improve farm efficiency, Increased automation, precision agronomy, water, soil and waste management.
3. Supply consistent **quality product and continuity of supply.**
   - Breeding for P&D resistance and quality attributes, improving storage regimes, optimising nutrition and harvest scheduling.
4. **Co-ordinated approach to R&D and technology transfer to farm level.**
   - Ensure advances are taken up and used for the benefit of the UK industry as a whole. Improve links with allied levy bodies, DEFRA and consultants.
5. Information to **promote consumption of home grown vegetables.**
   - Heightening the awareness of consumers to the health benefits of vegetables and encouraging consumption.



Aims

- No real treatment options for bacteria, except for copper oxychloride, which is toxic to the environment.
- Aim to promote plant defence response to help reduce bacterial load on plants.
- This project used treatments either already commercially available or with a good chance at being available soon (rather than 'raw' chemicals).

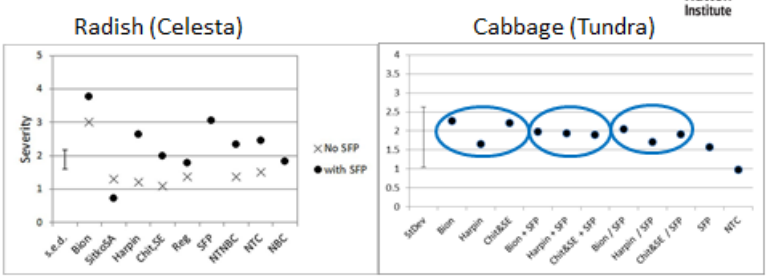
Are elicitors commercially available?

Product	Elicitor activity	Current use	Prospects
Amistar	Strobulurin	Brassicas: White Blister, Ring Spot, Altemaria Onion and Radish: Downy Mildew	Good
Signum	Strobulurin	Brussels sprouts, cabbage, broccoli and radish: Downy mildew	Good
Bion (Syngenta)	ASM: SA mimic	Actiguard (US) Label approved for various including Brassicas for Xanthamonas (black rot)	Good - Fair
Sitko-SA (Growth Products USA)	SA + phosphite	Sold as a fertilizer in the USA. Not currently sold in UK, but can be shipped.	Good - Fair
Softguard (Travena, UK)	Chitosan	Sold as a plant health-care or growth promoter product (fertiliser) in the UK	Good
Algal 600 products (Travena, UK)	Seaweed extracts, laminarin	Sold as a nutritional supplement in the UK, often combined with Softguard.	Good
Harpin (Plant Health Care, USA)	Secreted protein	Sold as a plant health promoter, available in the UK via Plant Health Care, UK office.	Good - Fair
Regalia / Reysa, Milsana (Syngenta)	Knotweed extract	To be marketed in Europe by Syngenta. Used on range of crops to control wide range of pathogens.	Good - Fair

Testing elicitor treatments for bacterial disease of Brassica

- *Variety differences (same pathogen diff. variety)*
- *Species differences (same plant diff. pathogen)*

Interactions with conventional fungicides

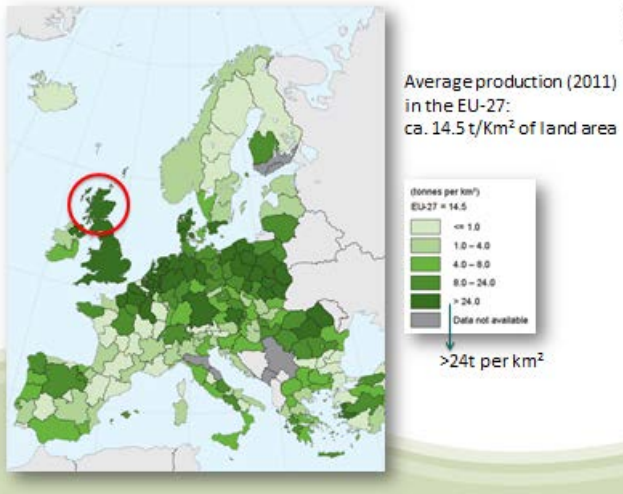


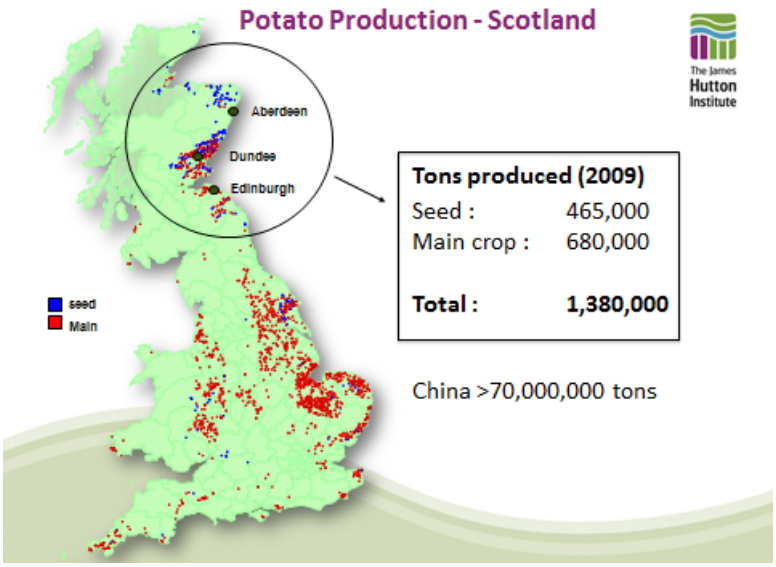
In some instances elicitors with SFP increased disease severity, e.g. Harpin on Radish.

Conclusion:

- **Elicitors can work, but in a very 'system' dependent manner**
- **Can be applied, but in an informed and targeted manner**

Potato production - Scotland



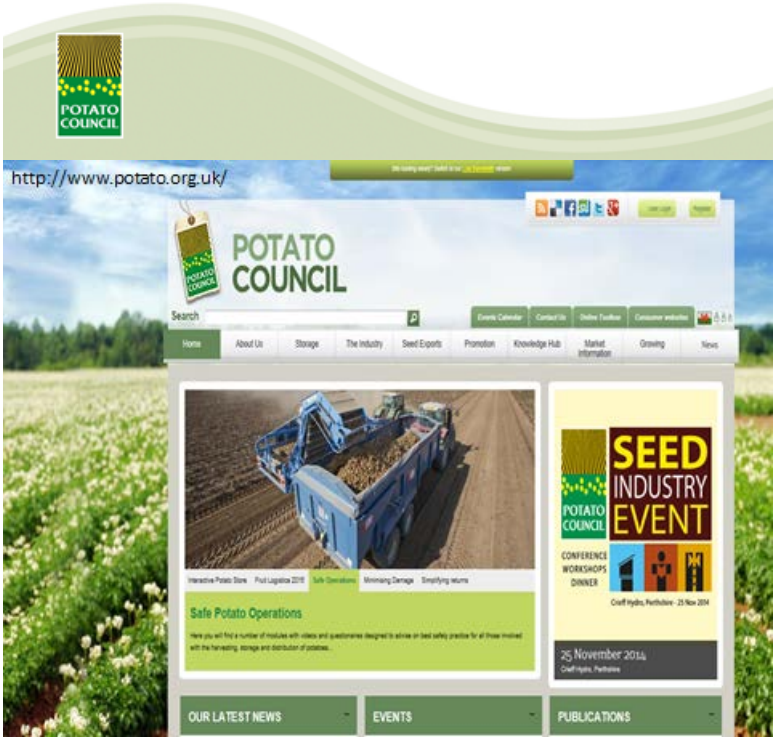


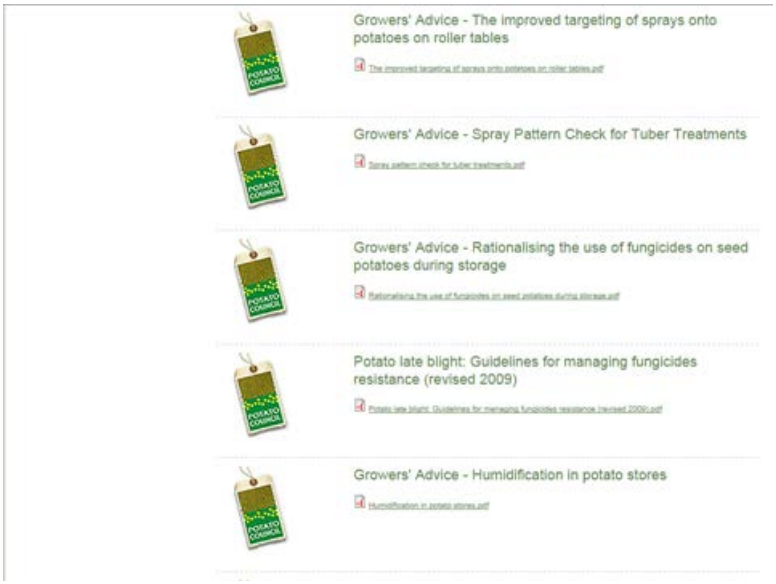
Potato

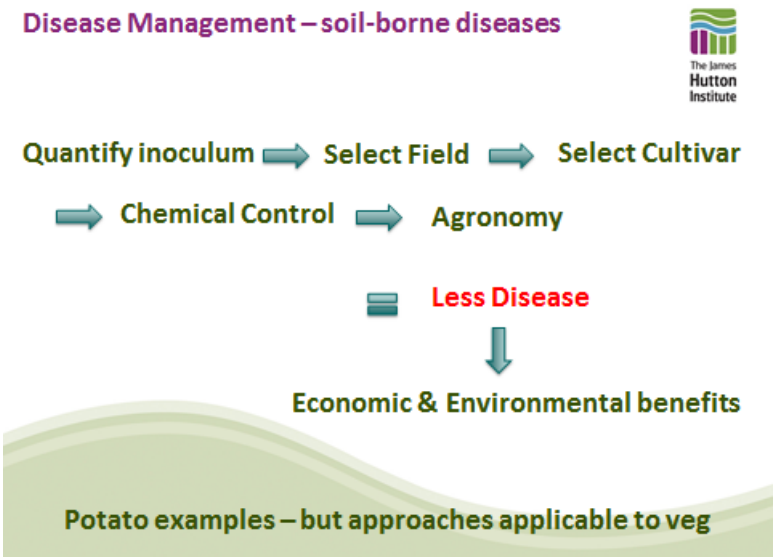
The James Hutton Institute

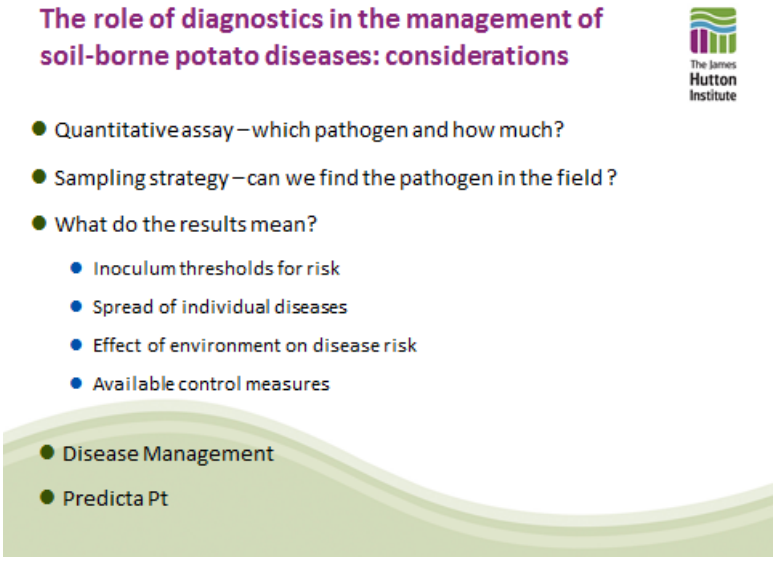
Potato Council

- **Projects aim to improve marketable yield, reduce defects, reduce input costs.**
- **Currently around 30 projects**
  - total value of ~£10m (£1m is levy payer funding, remainder coming from other sponsors such as Scottish Government, Defra, Technology Strategy Board, BBSRC and potato industry businesses).
- 5 key areas: pest; disease; agronomy; storage; and consumer-related research.
- Projects are carried out at research centres throughout the UK and they involve collaborators in Australia, New Zealand, Switzerland and South Africa.




Growers' Advice - The improved targeting of sprays onto potatoes on roller tables
Growers' Advice - Spray Pattern Check for Tuber Treatments
Growers' Advice - Rationalising the use of fungicides on seed potatoes during storage
Potato late blight: Guidelines for managing fungicides resistance (revised 2009)
Growers' Advice - Humidification in potato stores


Disease Management – soil-borne diseases
The James Hutton Institute
Quantify inoculum
Select Field
Select Cultivar
Chemical Control
Agronomy
Less Disease
Economic & Environmental benefits
Potato examples – but approaches applicable to veg


The role of diagnostics in the management of soil-borne potato diseases: considerations
The James Hutton Institute
Quantitative assay – which pathogen and how much?
Sampling strategy – can we find the pathogen in the field ?
What do the results mean?
Inoculum thresholds for risk
Spread of individual diseases
Effect of environment on disease risk
Available control measures
Disease Management
Predicta Pt

Quantitative assay

- Specific real-time PCR assays available for most potato pathogens
- Able to detect very low levels of pathogen DNA in plant, tuber, soil and water samples.
- DNA of a specific pathogen is quantifiable

Sampling strategy

Soil sampling strategy underpins the reliability of soil testing.

- must be representative of field scale
- must be practical (sampling and processing time and cost)
- based on "old" PCN sampling strategy.

- Sampling area: 4ha or less (divide larger fields)
- Sample size: 1Kg for standard testing
- Sampling points: 100 x 10g samples (0-15 cm depth)
- Sampling pattern: W pattern.

Brierley *et al.*, 2009. Quantifying potato pathogen DNA in soil. *Applied Soil Ecology* 41, 234-8.

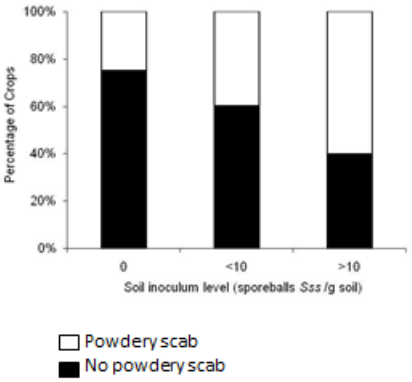
What do the results mean?

- **Inoculum Thresholds**

Monitoring of commercial potato fields

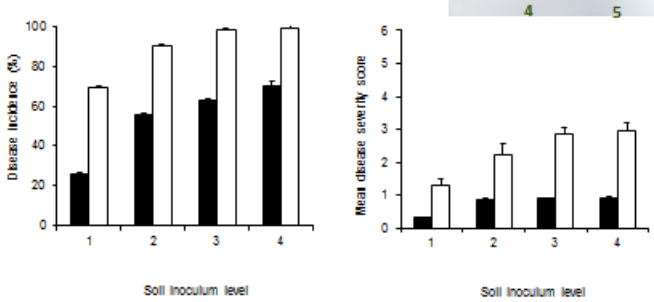
In commercial crops the risk of progeny tubers having powdery scab increased from 25% to 65% based on pre-plant levels of soil inoculum.

Seed-borne inoculum responsible for disease where no soil-borne inoculum detected



Inoculum levels: field trial results, powdery scab

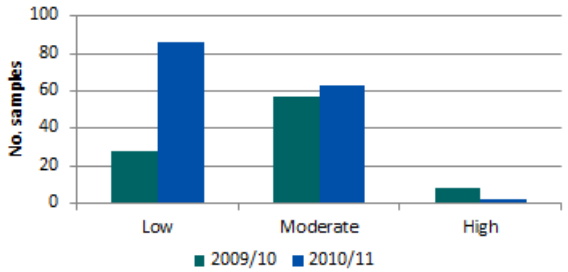
- Level 4 = 40-50 sporeballs/g soil.
- □ = Agria ■ = Nicola



Brierley *et al* (2013 in press). Relationship between *Spongospora subterranea* f. sp. *subterranea* soil inoculum level, host resistance and powdery scab on potato tubers in the field. *Plant Pathology*.

Commercial soil diagnostic testing - powdery scab SRUC 2009/10 and 2010/11

The James Hutton Institute

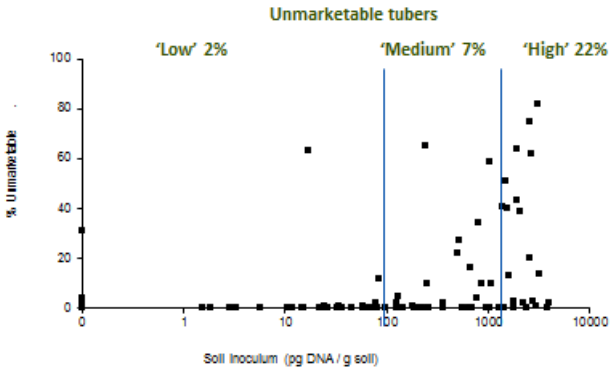


Conclusions

- Three years of field trial results show that the level of soil inoculum significantly affects amount of powdery scab on progeny tubers.
- Evidence towards use of diagnostic test for field selection

Colletotrichum coccodes - black dot soil inoculum

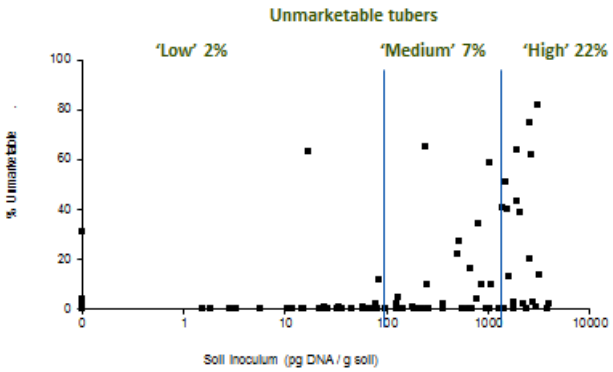
120 commercial fields x 3 years



Lees *et al* (2010). Relative importance of seed-tuber and soil-borne inoculum in causing black dot disease of potato. *Plant Pathology* 59, 693-702.

Colletotrichum coccodes - black dot soil inoculum

120 commercial fields x 3 years



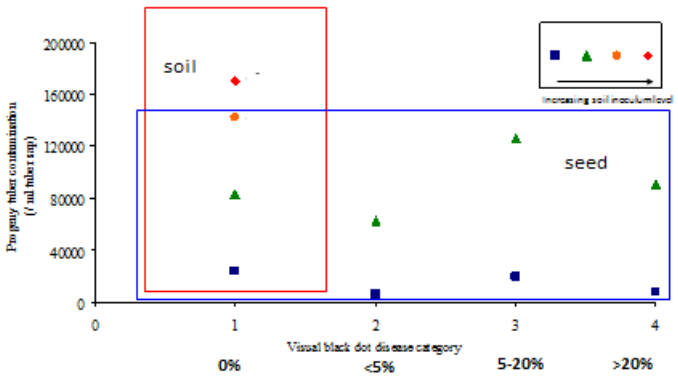
Lees *et al* (2010). Relative importance of seed-tuber and soil-borne inoculum in causing black dot disease of potato. *Plant Pathology* 59, 693-702.

What do the results mean?

- **Epidemiology of individual diseases**
  - Where does the inoculum come from ?
  - When does infection takes place?
  - What factors affect the development of symptoms?

Where does the inoculum come from?

Effect of seed- and soil-borne inoculum on progeny tuber contamination by *C.coccodes*



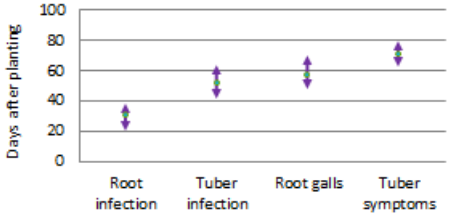
Lees *et al.*, 2010. Relative importance of seed-tuber and soil-borne inoculum in causing black dot disease of potato. *Plant Pathology* 59, 693-702

Powdery scab infection and symptoms

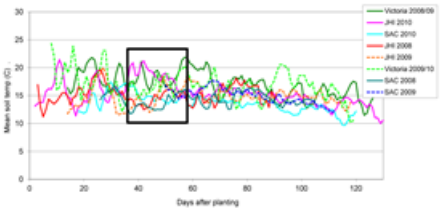
New information on infection and disease development

Trials in Scotland, Victoria, Tasmania

The James Hutton Institute

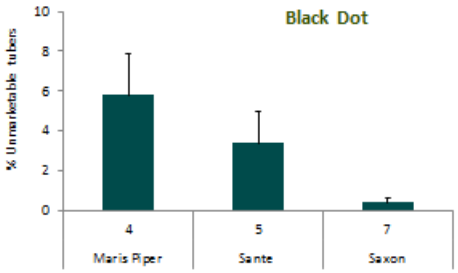


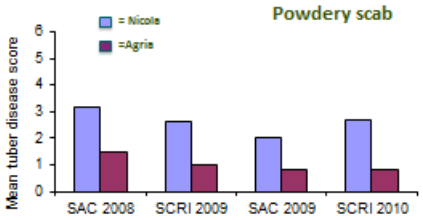
- Associated environmental variables known
- Can study relationship between environment and infection/disease



What do the results mean?

- **Control options**





Maxx, Lees et al (2012). Powdery scab resistance in *Solanum tuberosum*: an assessment of cultivar x environment effect. *Plant Pathology* 61, 29-36.

Control – black dot

The James Hutton Institute

- Over all trials, azoxystrobin reduced the percentage of tubers unmarketable due to black dot, from 26.7% to 14.6 % (Maris Piper), and from 12.9 % to 7.1 % (Sante).
- Longer crop duration (120-130 days from 50% emergence to harvest date) increases the risk of black dot developing, particularly where a high level of soil inoculum is present

Control - Powdery Scab

The James Hutton Institute

- Assess inoculum on seed and in soil
- Select fields and assign varieties accordingly
- Select a free-draining soil
- Avoid over-cultivation/compaction
- Avoid over-irrigation
- Consider chemical control
  - Fluazinam (Extension of Authorisation) in seed crops.

Disease risk assessment

The James Hutton Institute

- Soil test result → risk
- Variety grown → Reduce/increase risk
- Likely crop duration → Reduce/increase risk
- Irrigation → Increased risk
- Chemical control → Reduce risk (may depend on level of inoculum)
- Weather conditions ?

Late Blight?

Populations – implications for:
Fungicidal control
Host resistance
Prediction/risk
Precision approaches

Current and Future

- Field/site based diagnostics. Vegetables and sugar beet?
- PCN model – temperature v infestation
- Late blight, populations, field-based risk, precision approaches
- FLN as indicators of soil health
- FLN mapping & targeting of nematicide
- Tramline erosion/run-off (spread of pathogens)
- Optical imaging to detect disease risk/map fields

Stuart Wale
Alex Hilton
Daan Kiezebrink

Jeff Peters
James Woodhall

Peter Gladders
Faye Ritchie

Tonya Wiechel, Dept. Primary Industries, Aus.
Leigh Sparrow, Tasmania
Andrew Pitman, Plant & Food Research, NZ
Jacquie van der Waals, U of Pretoria, SA

Crop Duration

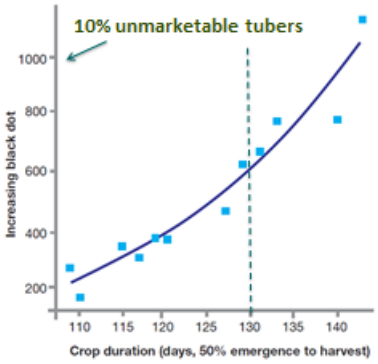
High Risk: Harvest date after early October or where crops are grown for a long duration (120-130 days from 50% emergence to harvest date)

Technical: Absolute date of harvest is less important than crop duration.

There is a good relationship between black dot development and crop duration (from 50% emergence to harvest)

The relationship is affected by maturity group – for susceptible maincrop varieties risk of economic loss is higher after 130 days

Crop Duration



Disease accumulated after 20 weeks storage (@ 3.5C after rapid pull-down

Action: Harvest by early October or limit duration in ground according to susceptibility and maturity group

Dr Krishna Subbarao's presentation at Industry Workshop

Broccoli-Mediated Pathogen and Disease Suppression in Vegetable Cropping Systems

K. V. Subbarao

Department of Plant Pathology
University of California, Davis

GROSS PRODUCTION VALUE

CATEGORIES	2013 TOTAL VALUE	2012 TOTAL VALUE*
Vegetable Crops	$2,833,775,000	$2,557,772,000
Fruit & Nuts	$1,159,589,000	$1,057,684,000
Nursery Crops	$312,346,000	$307,543,000
Livestock & Poultry	$45,024,000	$53,126,000
Field Crops	$19,990,000	$19,338,000
Seed Crops	$8,803,000	$8,550,000
Apiary	$195,000	$204,000
TOTALS	**$4,379,722,000**	**$4,004,217,000**

		1993	2003	2013
TOTAL OF MAJOR CROPS ABOVE	Acre	242,482	276,648	282,681
	Value	$1,430,953,000	$2,446,538,000	$3,668,394,000
	CPI Adjusted	$2,307,987,000	$3,096,883,000	$3,668,394,000

Monterey County's Ten Million Dollar Crops

CROPS	2013 CROP VALUE	2013 CROP RANKING	2012 CROP RANKING
Strawberry	$869,488,000	1	1
Leaf Lettuce	$659,646,000	2	2*
Head Lettuce	$550,628,000	3	3
Broccoli	$426,933,000	4	4
Celery	$217,452,000	7	7
Misc. Vegetables	$173,602,000	8	8
Cauliflower	$163,319,000	9	10
Spinach	$122,676,000	10	9
Mushrooms	$71,534,000	11	12
Salad Products	$70,577,000	12	13
Spring Mix	$70,140,000	13	11
Artichokes	$47,390,000	14	14
Cabbage	$45,127,000	15	16
Raspberries	$43,791,000	16	15

Background

- Extensive surveys revealed the high degree of susceptibility of cauliflower and near-immunity of broccoli to Verticillium wilt.
- *Verticillium dahliae* isolates from crucifer crops were weakly pathogenic on broccoli in greenhouse tests, and others were non-pathogenic.
- Dry crucifer residues are better than fresh residue.

Reaction of broccoli to *Verticillium dahliae* from various hosts

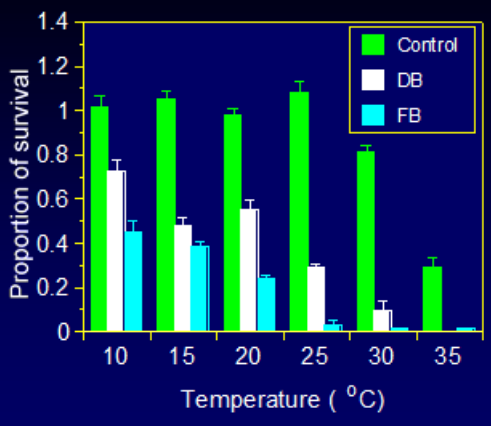
Isolate	Disease severity	Dry weight (g) Root	Shoot
Cauliflower	1	2.31	4.07
Chili pepper	0	2.57	3.90
Artichoke	1	2.28	3.58
Cabbage	1	2.18	4.34
Lettuce	0	2.52	4.02
Strawberry	0	2.41	3.60
Bell pepper	0	2.50	4.23
Eggplant	0	2.57	3.61
Tomato	1	2.14	4.06
Watermelon	0	1.90	3.75
Mint	1	2.29	4.22
Potato	1	2.79	3.62
Cotton	0	3.03	4.17
Alfalfa (*albo-atrum*)	0	2.61	3.97
Control	0	2.71	4.42
LSD ($P \leq 0.05$)		0.55	0.58
Cauliflower	5	1.80	2.25

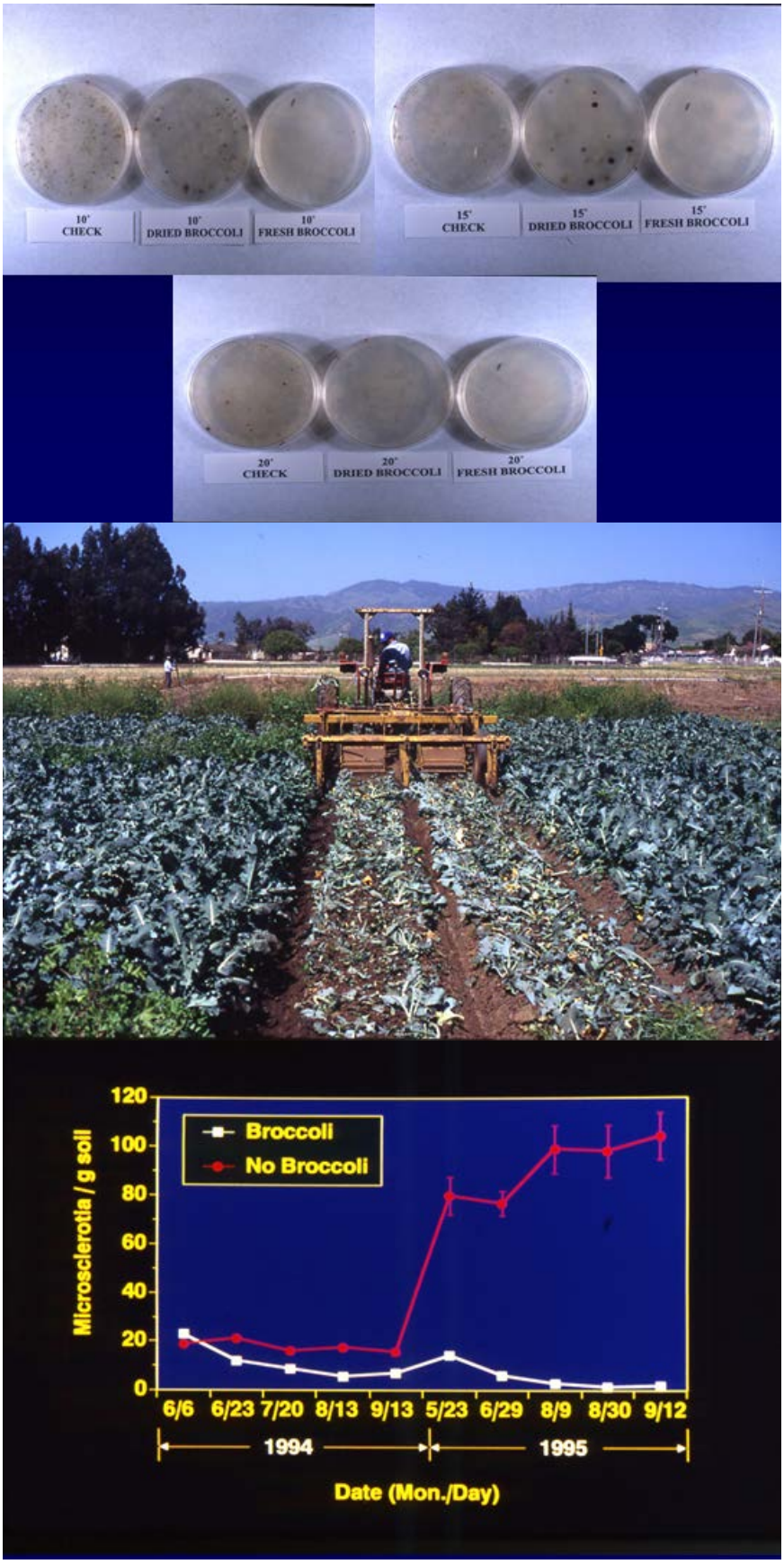
Questions

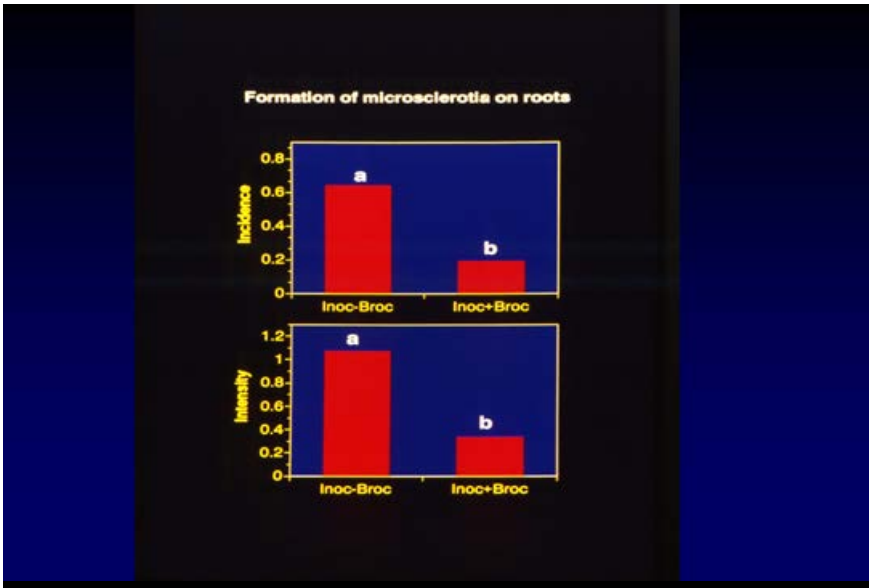
- When should the broccoli crop be planted and residue incorporated?
- Is there a specific temperature at which propagule reduction by broccoli is maximized?
- Is dry broccoli better than fresh broccoli?

Methods

- Soil: Fields 1 & 2
- Treatments: Fresh (8%), dry, and no broccoli in 25 g dry soil.
- Incubation: 10, 15, 20, 25, 30, & 35 C
- Assay: After 45 days incubation using the Anderson sampler technique.
- In a parallel set of experiments, soil sampled after 15, 30, and 45 days incubation and assayed.



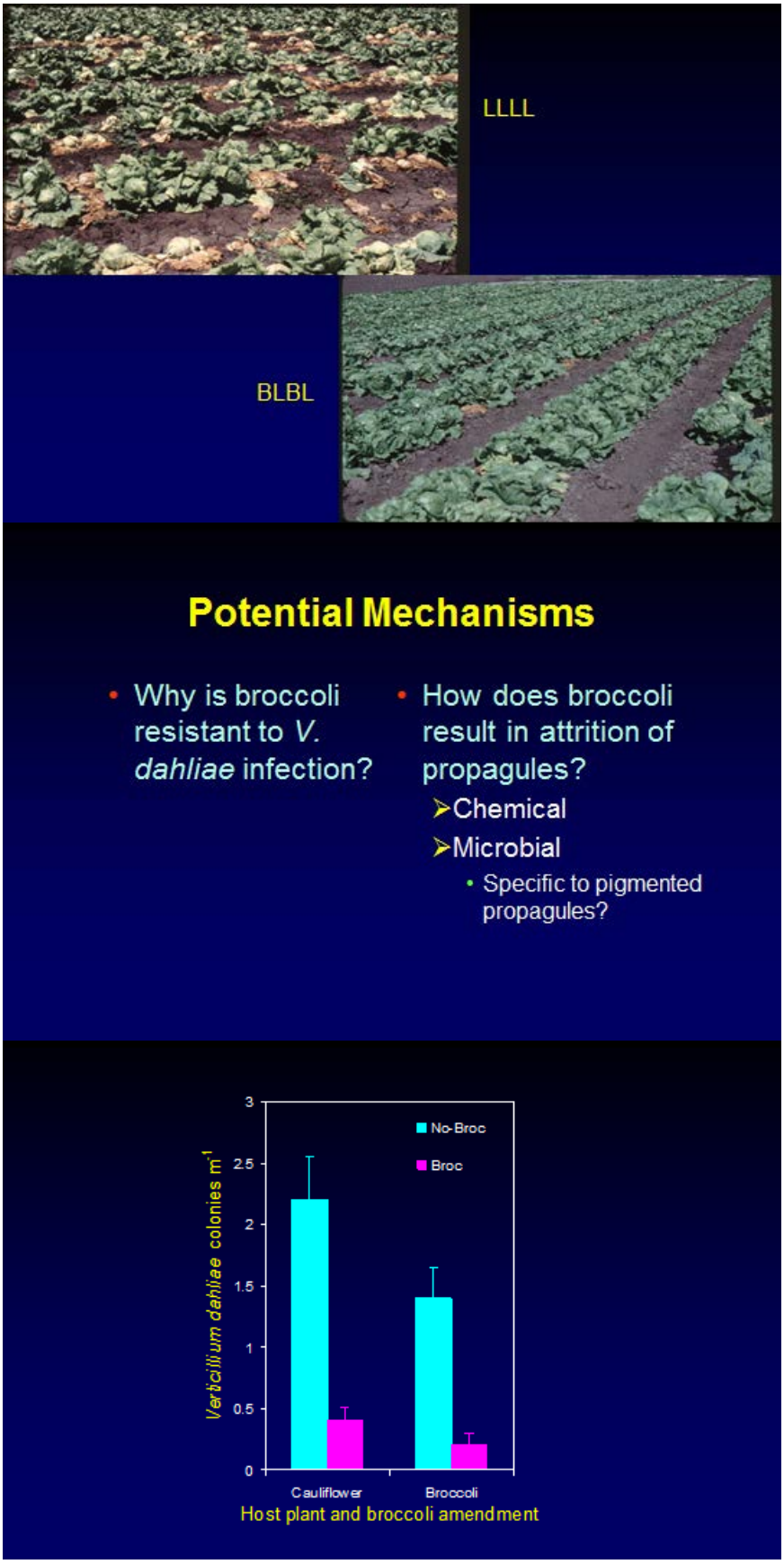

10' CHECK
10' DRIED BROCCOLI
10' FRESH BROCCOLI
15' CHECK
15' DRIED BROCCOLI
15' FRESH BROCCOLI
20' CHECK
20' DRIED BROCCOLI
20' FRESH BROCCOLI
Broccoli
No Broccoli
Microsclerotia / g soil
120
100
80
60
40
20
0
6/6 6/23 7/20 8/13 9/13 5/23 6/29 8/9 8/30 9/12
1994
1995
Date (Mon./Day)

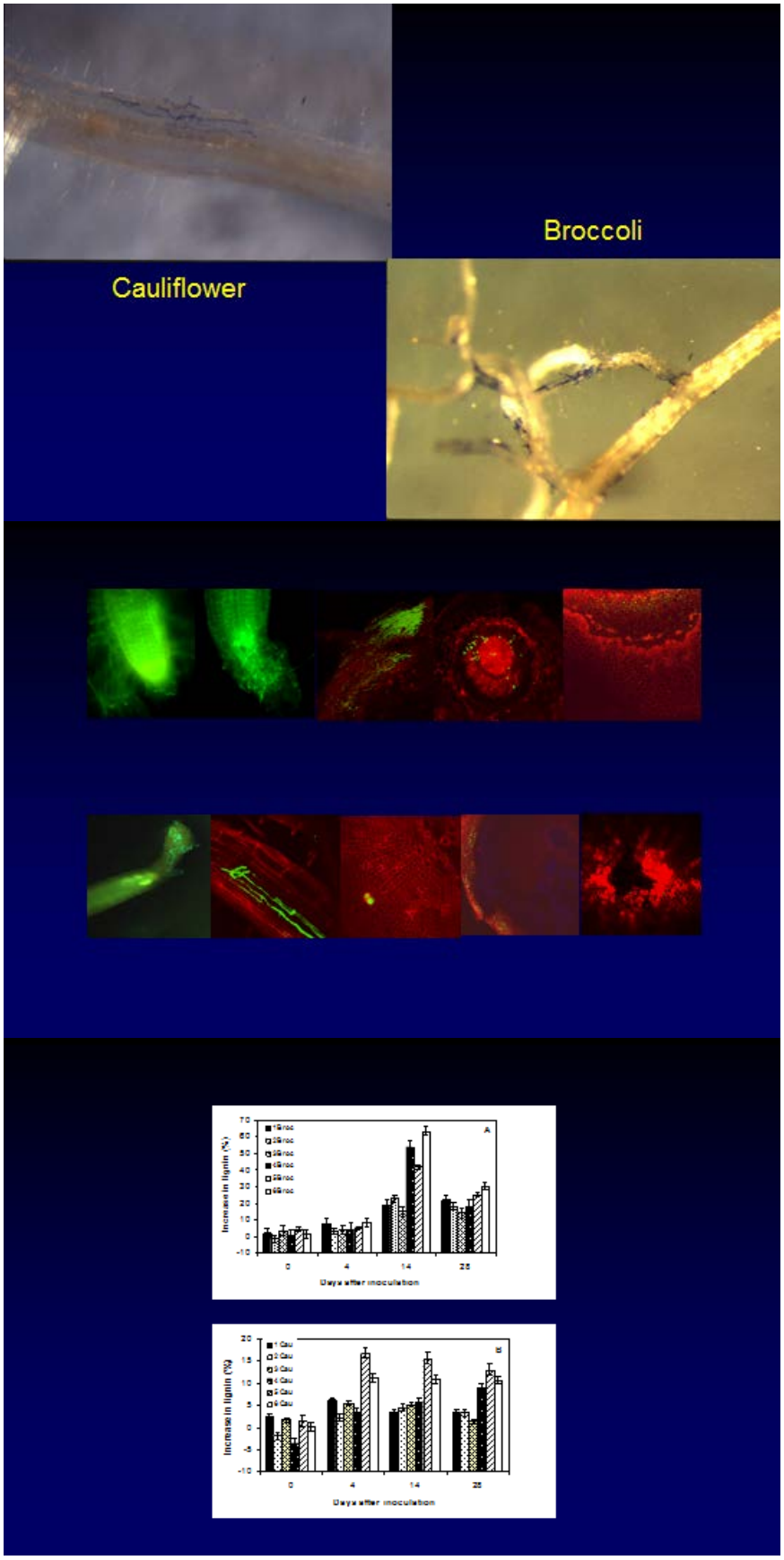


Are all broccoli varieties same?

Other Applications of this Research

- Efficacy of Broccoli - Strawberry Rotation
- Conventional versus organic production systems
- Reductions in *Sclerotinia minor* sclerotia and lettuce drop incidence.


LLLL
BLBL
Potential Mechanisms
Why is broccoli resistant to V. dahliae infection?
How does broccoli result in attrition of propagules?
Chemical
Microbial
Specific to pigmented propagules?
Verticillium dahliae colonies m-1
3
2.5
2
1.5
1
0.5
0
No-Broc
Broc
Cauliflower
Broccoli
Host plant and broccoli amendment


Broccoli
Cauliflower
Increase in lignin (%)
Days after inoculation
A
Increase in lignin (%)
Days after inoculation
B

Summary of cover crop biomass and equivalent metam sodium content

Treatment	Biomass (T/A) 2004	Biomass (T/A) 2005	N (lb/A) 2004	N (lb/A) 2005	Metam sodium Eq (gal/A) – 2005
Broccoli	2.08	1.84	132.8	71.0	0.11
White Mustard	2.51	1.78	194.8	130.8	2.28
Indian Mustard	2.23	1.33	199.7	120.5	1.69

Labelled rates of metam sodium 30 -75 gal/A

Soil Microbiological Changes

Significant differences between broccoli and cauliflower.

Broccoli residue incorporation results in 100-fold increases in bacteria and 1000-fold increase in actinomycetes.

Not only these changes are quantitative but also qualitative. The diversity of these groups is highest in broccoli-amended soils compared with cauliflower-residue amended soils.

Bacterial diversity - Broccoli

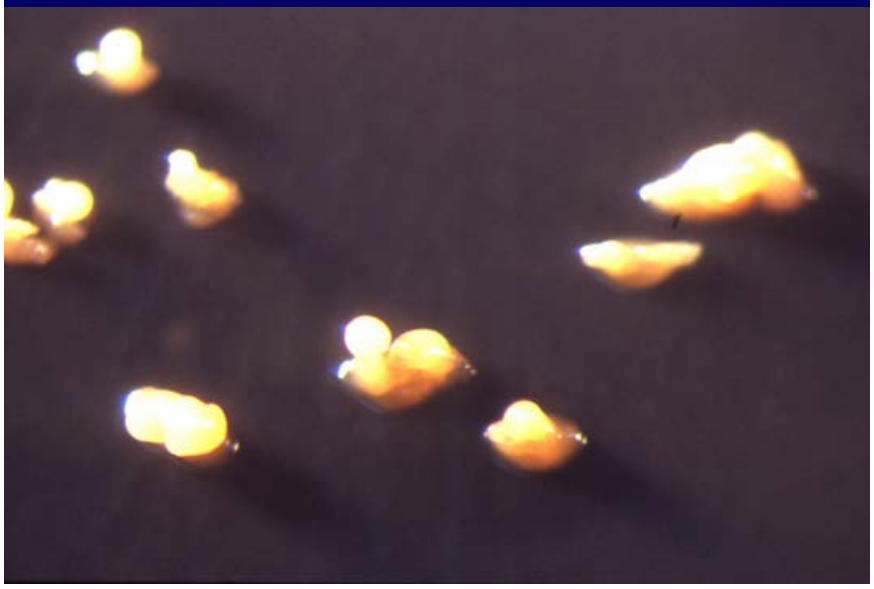
- *Arthrobacter saperdae*
- *A. barkeri*
- *A. oxydans*
- *A. ramosus*
- *A. viscosus*
- *Aureobacterium esteraromaticum*
- *Bacillus circulans*
- *B. atrocyaneus*
- *B. brevis*
- *B. lentus*
- *B. pantothenticus*
- *B. psychrophilus*
- *B. pumilus*
- *Micrococcus lylae*
- *M. kristinae*
- *M. roseus*
- *Pseudomonas florescens*
- *Stephylococcos epidermis*
- *S. cohnii*
- *Stenotrophomonas maltophilia*

Bacterial diversity – non-broccoli

- *Bacillus chlororaphis*
- *B. laterosprus*
- *B. linens*
- *B. psychrophilus*
- *Curtobacterium inologenes*
- *C. flaccumfaciens*
- *Micrococcus halobius*
- *Pseudomonas putida*

Myxobacteria

- Gram negative, gliding bacteria
- Produce swarms on nutrient poor media
- Produce characteristic fruiting bodies with dormant myxospores
- Lytic activity on microorganisms and nematodes

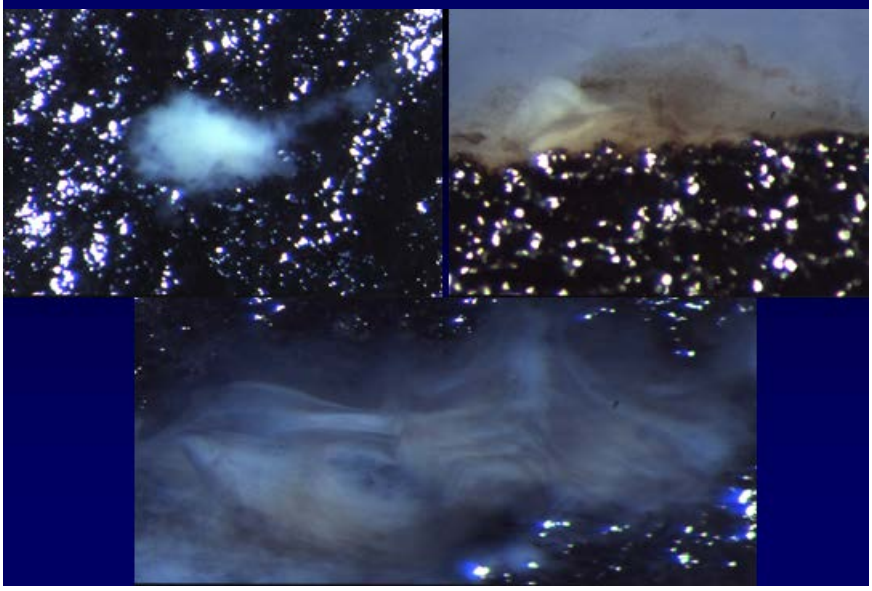


Myxobacteria

- *Myxococcus coralloides*
- *M. fulvus*
- *M. virescens*
- *M. xanthus* (2)
- *M. stipitatus*
- *M. flavascense*

Benefits of Melanin

- Abiotic Stress
  UV radiation, temperature extremes, desiccation, free radicals, metal toxicity
- Biotic Stress
  Soil microbial/host plant origin hydrolytic enzymes and free radicals
- Pathogenicity
  Appressorial penetration, virulence factor?




Control plot (minus Broccoli)
Plot rotated with Broccoli
Research Team
Chang-Lin Xiao
Li Liu
Ashley Bell
Ravi Bhat
Kateel Shetty
Judy Hubbard
Steve Koike
Qingming Qin
Gary Vallad
Cauliflower growers
USDA-NRICGP
USDA-CSREES
USDA-SARE
CA-DPR
CA Lettuce Research Board
CA Strawberry Commission
UCIPM

CONCLUSION

The ASDS8 conference was a success. Informal feedback from participants and invited speakers praised the quality of the meeting and the opportunities it raised.

The invited speakers were well received by both the scientific community and industry at the workshop. In particular, Prof Subbarao's presentation on the limitations of biofumigants, but success with changes in farming systems was illuminating given current interest in biofumigants.

TECHNOLOGY TRANSFER

SCIENTIFIC CONFERENCE PAPERS

The ASDS8 conference featured 50 oral and 24 poster presentations relating to soil-borne disease (see attached program).

INDUSTRY & MEDIA PUBLICATIONS

Two articles about the keynote speaker featured within Vegetables Australia and Potatoes Australia.

One article interviewed Prof. Krishna Subbarao (UC Davis, USA) and focussed on his work with Verticillium dahliae and Sclerotinia spp. in Californian vegetable production systems. These diseases are very topical for Australian producers. His outcomes highlighted how changes in farming systems had dramatic effects on disease incidence.

The other article interviewed Dr Alison Lees, and focussed on her insights into potato diseases, and collaborations with Australian researchers within the APRP#2 program.

- "International research on show in Tasmania". Vegetables Australia Jan/Feb 2015: 38-39.
- "International researcher shares knowledge with Tassie growers". Potatoes Australia Dec/Jan 2015: 18-19

Interviews during the conference by Dr Calum Wilson and Prof Subbarao were featured on radio during the ABC country hour.

An article on the ASDS conference appeared in the Tasmanian Country newspaper featuring interviews from Dr Jason Scott, Dr Robert Tegg and prof Krishna Subbarao.

INDUSTRY & PEER PRESENTATIONS

The industry workshop held at the Forthside Research Farm provided an opportunity for the Tasmanian vegetable sector to engage with the key note speakers.

The workshop featured presentations from both speakers followed by a formal question time and lunch with informal discussions.

PROJECT RECOMENDATIONS

The ASDS meetings are of critical importance to Australian horticulture. they provides one of the few opportunities for Australasian specialists in soil-borne disease to meet and discuss the latest developments in this field. There are many unanswered questions relating to control of soil-borne disease. This is reflected in the proportion of R, D&E projects in this area. With diminishing resources invested in soil-borne disease research it is imperative that those active in the area share information and form collaborations to use these resources in the most efficient manner. ASDS provide a perfect venue for such developments.

We recommend HIA consider sponsorship opportunities for future iterations of this important meeting (the next to be held in Hamner Springs, New Zealand)