An Integrated Disease Management program for the Australian almond industry (AL16005)

Dr Jacqueline Edwards
Agriculture Victoria

SUPPORTED BY:
Horticulture Innovation Australia Ltd

HOSTED BY:
The Almond Board of Australia

18th Australian Almond Conference
Pullman Hotel Melbourne, Albert Park, Victoria
October 30th - November 1st, 2018

Project Objective

"To improve on-farm management of economically important almond diseases, and to ensure these practices are communicated to, and adopted by, growers and industry"

- Conduct disease surveys across major almond-producing regions to determine prevalence and impact
- Determine the causes and epidemiology of the major diseases
  - hull rot and lower limb dieback/trunk disease
- Identify effective management practices
- Develop integrated disease management (IDM) guidelines suitable for almond production in Australia

Project team

Victoria:

Dr Jacqueline Edwards
Dr Tonya Wiechel
Simone Kreidl
Peta Faulkner
Anjali Zaveri (PhD)

AGRICULTURE VICTORIA

South Australia:

Dr Mark Sosnowski
Dr Suzanne McKay
Brittany Oswald

New South Wales:

Dr Len Tesoriero

CROP DOC

Stuart Pettigrew AgDynamics

Industry-wide disease surveys

Almond diseases

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Hull rot

Anthracnose

Rust

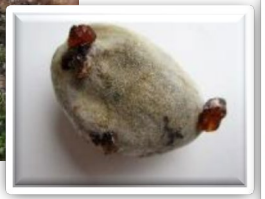
Shot hole

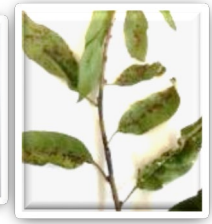
Trunk disease / lower limb dieback

Phytophthora

Scab

Cankers





Bacterial spot

Preliminary survey sampling (2018)

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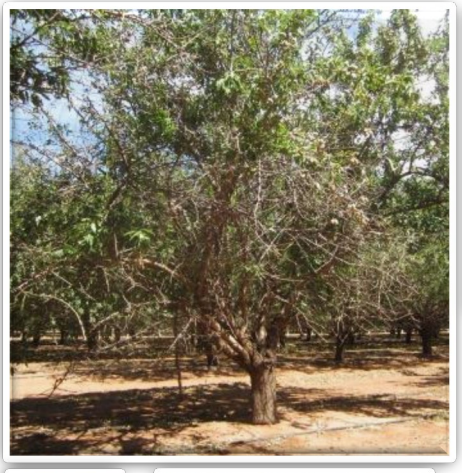






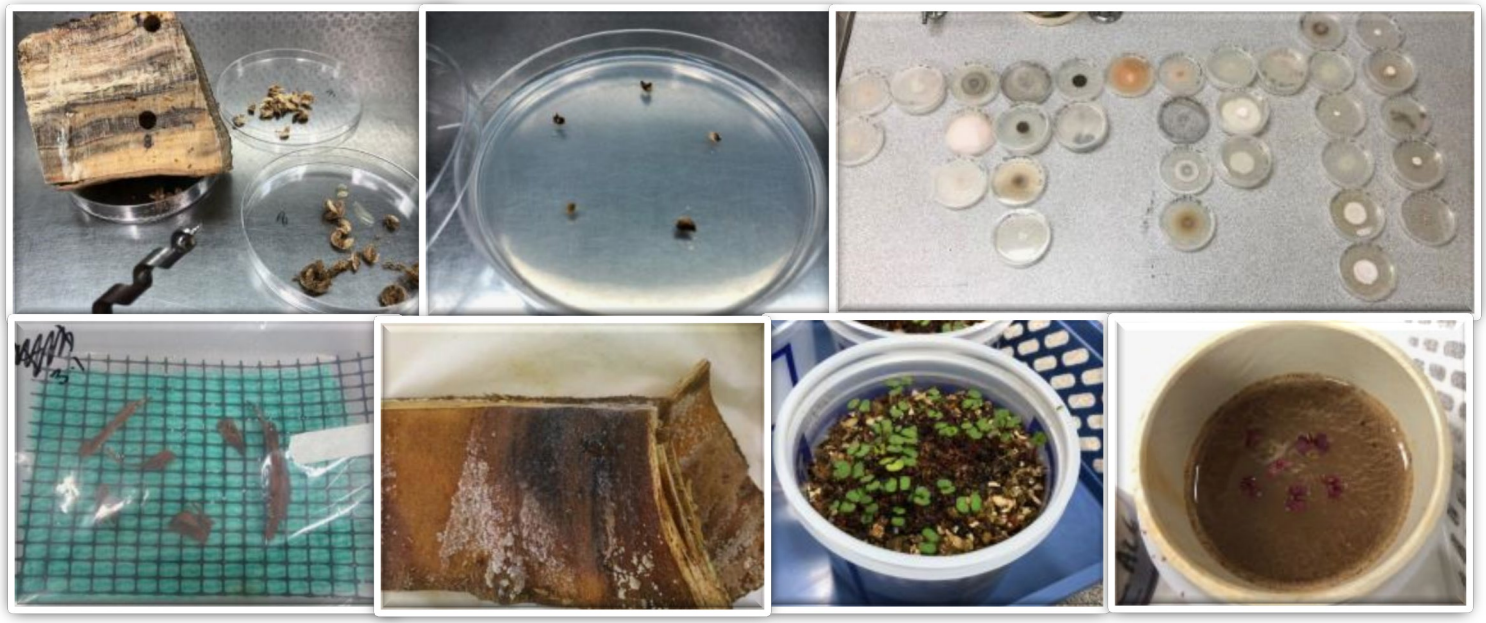






Targeted, grower-based, to refine methods, to determine causes

Preliminary survey sampling (2018)



DNA sequencing

- Pathogens isolated, purified and identified
- 200+ reference isolates catalogued and stored

Grower census

Survey Monkey questionnaire designed and sent out to industry via ABA in June 2018

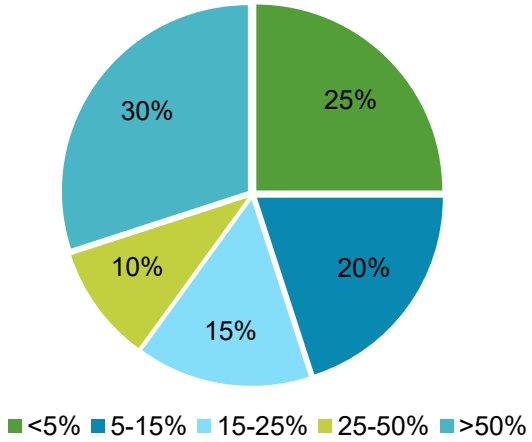
- To provide baseline information
- To source disease survey participants
- To ensure industry-wide coverage

	Total industry % (ha)	Responses to census	Region coverage % (ha)
Sunraysia (VIC)	56% (22,390)	6	27% (6,013)
Riverina (NSW)	20% (7,885)	2	16% (1,252)
Riverland (SA)	20% (7,910)	9	32% (2,521)
Adelaide Plains (SA)	2% (724)	3	9% (64)
Total	**98% (39,662)**	**20**	**25% (9,850)**

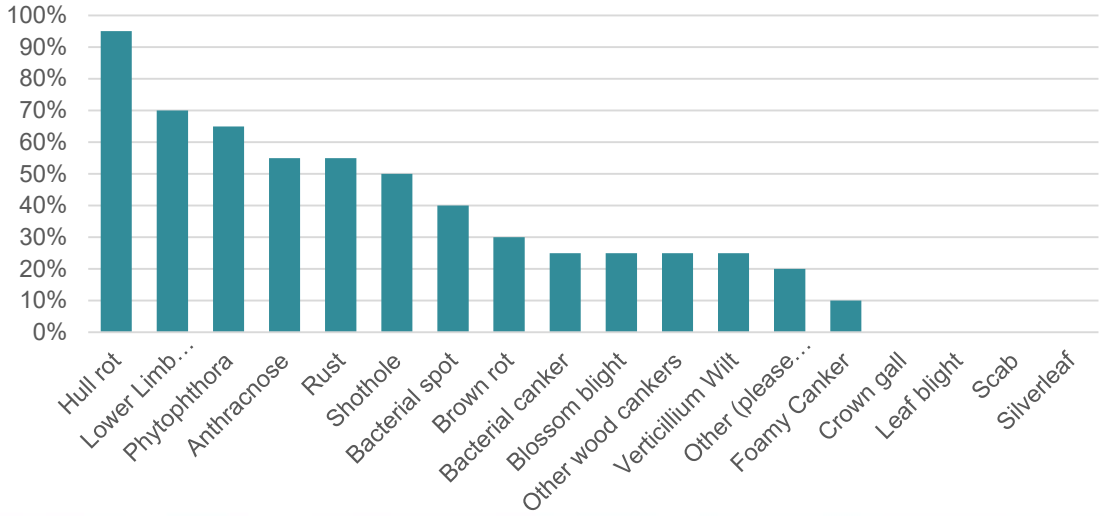
Growers' perception of almond diseases

- Impact: 40% respondents believe >25% of their orchard is affected by disease
- Prevalence: 95% hull rot, 95% trunk diseases (LLD + wood cankers), 65% Phytophthora

Approximately, what percentage of your orchard is affected by disease(s)



What almond diseases do you have?



Disease surveys 2019-2020

Industry-wide survey planning underway

- Appropriate survey methodology designed
- Grower census completed
- Three survey periods/season
  - November
  - Pre-harvest (Jan/Feb)
  - May
- Commencing Nov 2018

Lower limb dieback / trunk diseases and hull rot research

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The Californian connection

Dr Themis Michailides
Dr Flourent Trouillas

November 2017 – SA

July 2018 – Jacky Edwards

- Hull rot
- Collaboration on PhD

September 2018 – Brittany Oswald

- LLD & trunk diseases
- Symptoms/diagnostics/methodology

LLD / trunk diseases – complex aetiology

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(Cv. Monterey – 10 years old) 1/3/2018

2.1	1	Ap?	
	2	Ap? (AL5-1)	
2.2	1	Green fluffy (AL5-2), Pink fluffy (AL5-3), Ap? (AL5-4), dense white/red (AL5-5)	
	2	-	
	3	Green fluffy (AL5-6), Brown (AL5-	
	4	Green/brown dense (AL5-8), white dense (AL5	
2.3	1	-	
	2	-	
	3	Dense dark green (AL5-10), Ap? (AL5-11)	
2.4	1	Pink/dense (AL5-12)	
	2	-	
	3	-	
2.6	1	Ap? (AL5-13), pen	
	2	Ap?, green fluffy (AL5-14	
	3	Ap?	
	4	White/green rings (AL5-15), rusty sparse (AL5	
2.7	1	pen	
	2	Ap?, Pen	
	3	White sparse), white dense (AL5-18, AL5	
	4	Ap? (AL5-20)	
	5	Brown rusty s AL5-21), cream sparse (AL5-22), white dense (AL5-23)	
2.8	1	-	
	2	White dense (AL5	
	3	White dense (AL5-25	
	4	White dense (AL5-26 se (AL5-	

Common pathogens

- *Diplodia seriata*
- *Eutypa lata*
- *Cytospora* spp.

Hull rot – aetiology

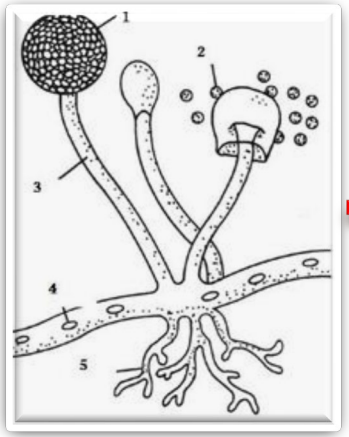
In California:

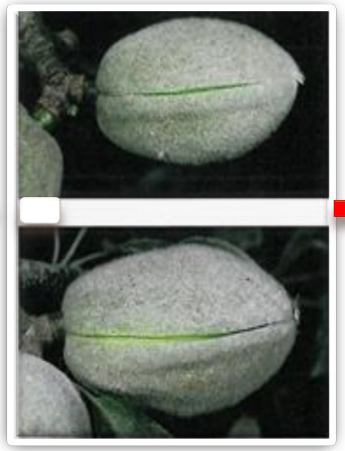
- *Rhizopus stolonifer*
- *Aspergillus niger* complex
- *Monilinia* spp.
- *Neoscytalidium dimidiatum*

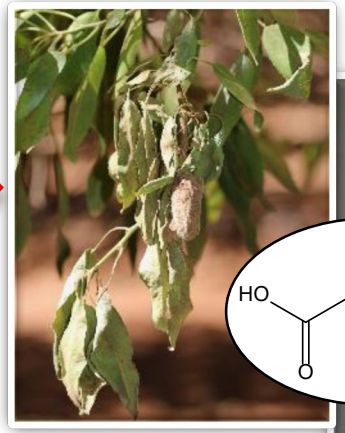
In Australia?

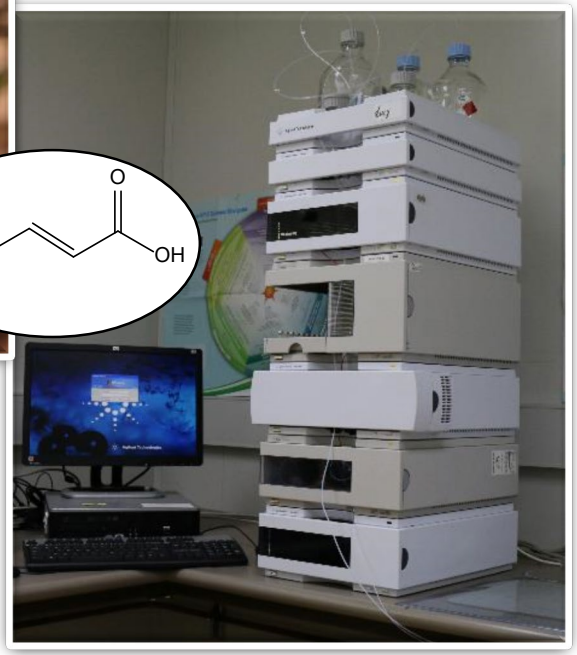
- *Rhizopus stolonifer*
- *(Monilinia fructicola)*

Hull rot symptoms









Rhizopus stolonifer colonises inside hull of young nut

- by-product: soluble fumaric acid
- translocated to nearby leaves and readily metabolised
- kills tissues and causes spur death ie hull rot “strikes”

- Methodology established for tracking fumaric acid production in almond tissue

Hull rot epidemiology – role of mummies?

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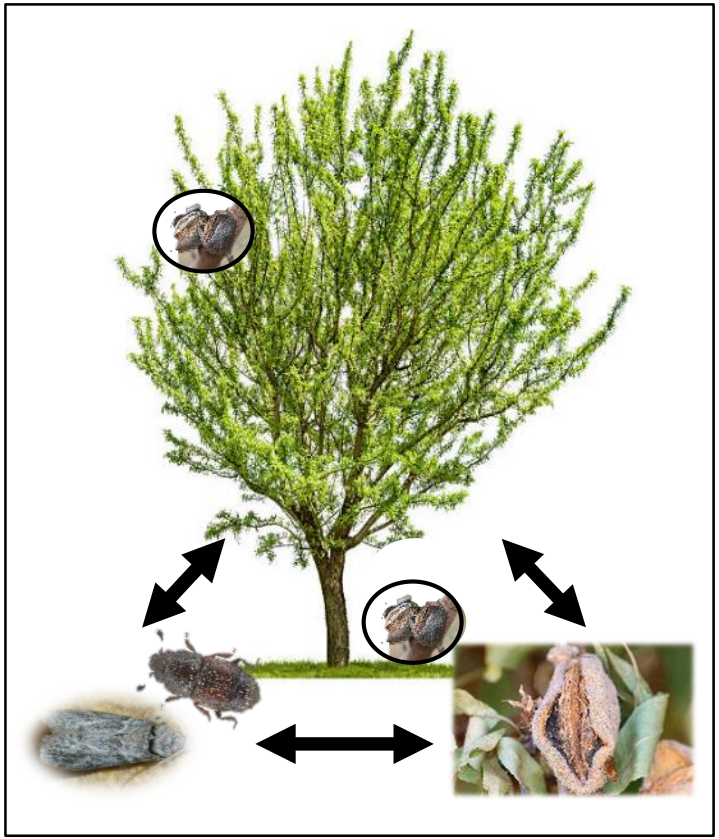


In collaboration with AL16009 Almond IPM

- Insect interaction?
- Inoculum source?
- Sanitation?

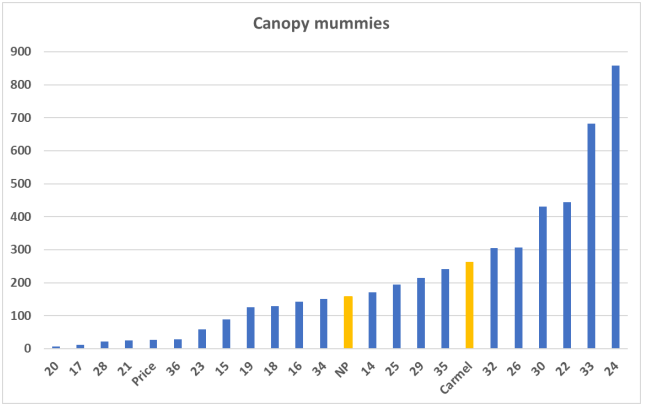
Mummy density	Blocks
<4	7
4 to 9	10
10 to 19	4
20 to 40	6
>40	2

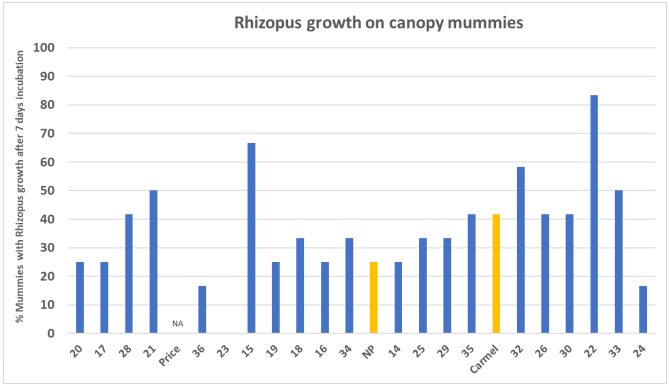
Hull rot - variety evaluation

AL12015: Almond Breeding Program

- 24 varieties, planted 2013
- Mummies / variety
- Rhizopus / mummy

In Jan/Feb: HR strikes /variety





Hull rot management

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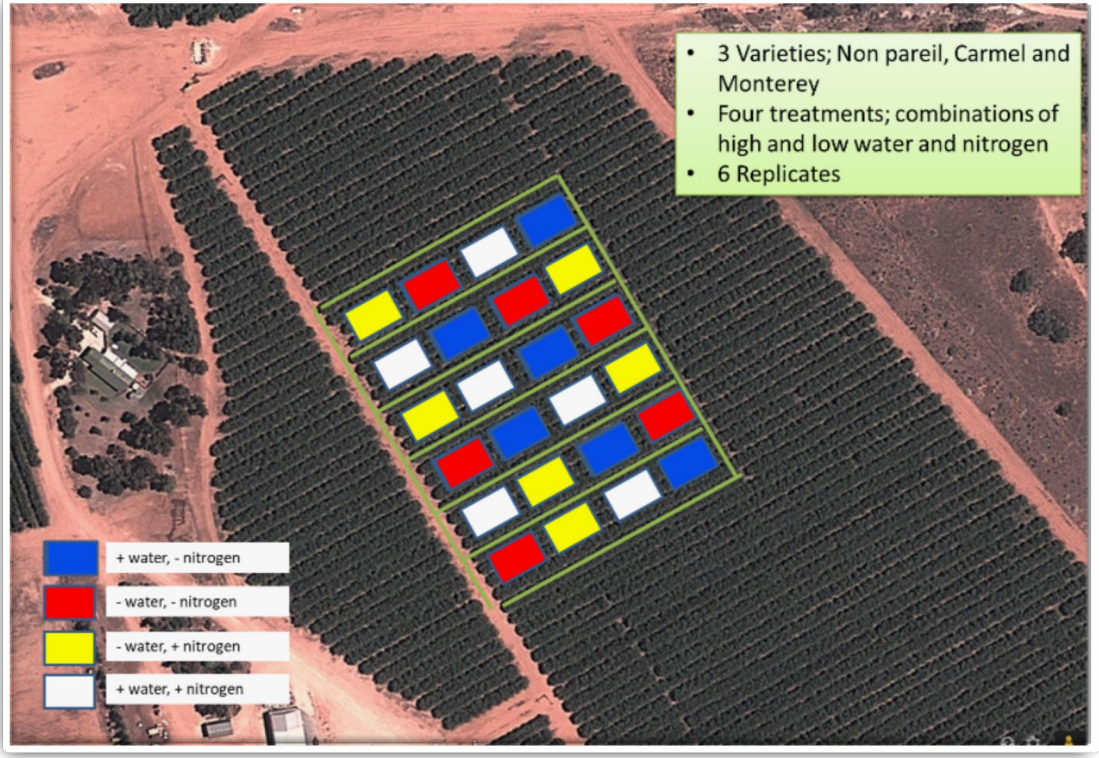
AL14005: Influence of nitrogen and water?



AL16009: Spray coverage?

Planned research for both diseases (HR & TD)

Pathogenicity

- glasshouse
- preliminary trial on established trees (AL12015, TD)

Environmental conditions (HR)

- Laboratory, glasshouse & field (Aus & USA)

Varietal susceptibility

- young trees purchased and potted

Fungicide effectiveness

- laboratory, glasshouse & field

Alternative treatments (HR)

e.g. early harvest, alkalis, BCAs, other

Acknowledgements

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USA

Dr Flourent Trouillas

Dr Themis Michailides

Australia

AL16009 Almond IPM Program

AL12015 Almond Breeding Program

AL14005 Almond Productivity Program

Collaborating almond growers

AL16005 Almond IDM team

Hort Innovation Strategic levy investment | ALMOND FUND

This project has been funded by Hort Innovation using the almond research and development levy and funds from the Australian Government. For more information on the fund and strategic levy investment visit horticulture.com.au

australian almonds