AL16005: An integrated disease management program for the Australian almond industry

Dr Jacqueline Edwards, Agriculture Victoria

Loxton R&D Forum, 30th October 2019

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Five year collaborative project (2018-2022)

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australian almonds

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"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 (Yrs 1-3)
- Determine the causes and epidemiology of the major diseases: hull rot and lower limb dieback/trunk disease (Yrs 1-4)
- Identify effective management practices (yrs 2-4)
- Develop integrated disease management (IDM) guidelines suitable for almond production in Australia (yrs 4-5)

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Industry-wide disease survey
(designed by AVR biometrician Khageswor Giri)

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Preliminary survey sampling (2017 - 18)

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

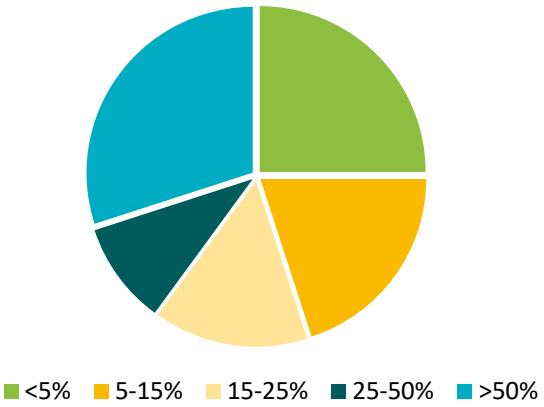
Survey Monkey questionnaire designed and sent out to industry via ABA in June 2018

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

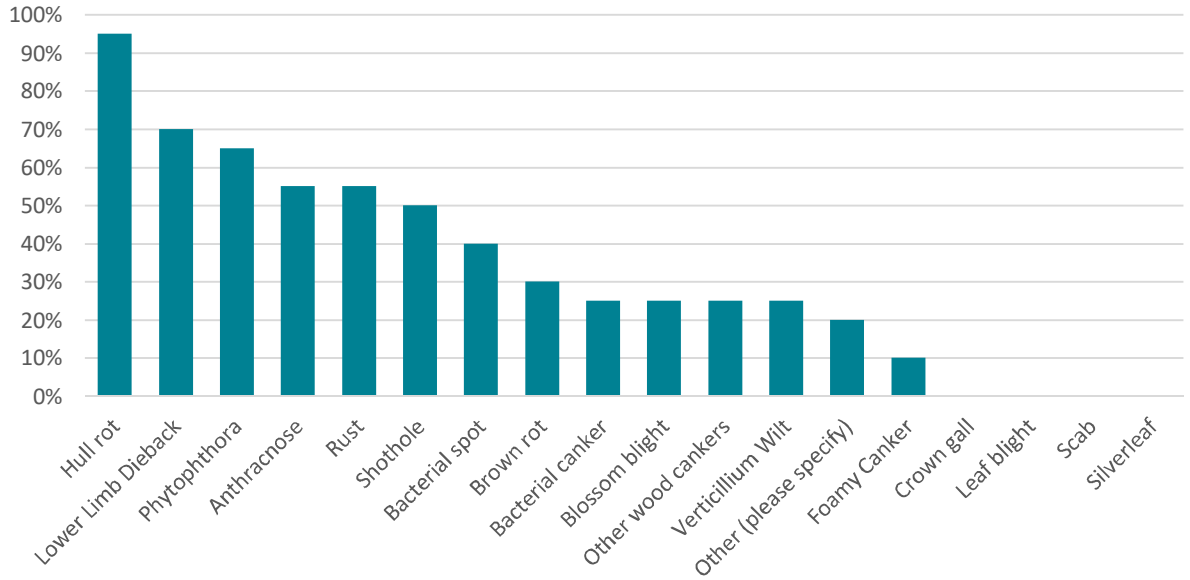
District	Region total % (ha)	Region coverage % (ha)
Sunraysia (VIC)	56% (22,390)	27% (6,013)
Riverina (NSW)	20% (7,885)	16% (1,252)
Riverland (SA)	20% (7,910)	32% (2,521)
Adelaide Plains (SA)	2% (724)	9% (64)
Western Australia	2% (800)	100% (800)
Total	**100% (40,462)**	**26% (10,650)**

Growers' perception of almond diseases

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

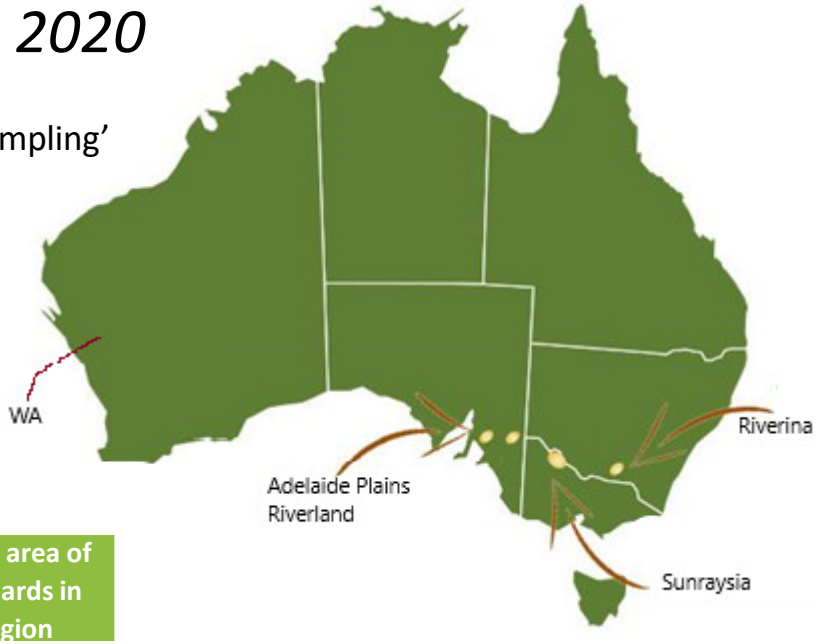


What diseases do you have?



Disease surveys 2018 - 2020

- Methodology: 'two-stage cluster sampling'
- Tagged >2000 trees
- 2 seasons
- 2 survey periods/season
  - November
  - Pre-harvest (Jan/Feb)



Region	Number of Orchards	Number of blocks surveyed	Total area of blocks surveyed	Total area of orchards surveyed	Total area of orchards in region
Sunraysia	10	49	507	5866	22390
Riverland	9	48	433	1515	7910
Riverina	3	17	118	1600	7885
Adelaide Plains	3	6	49	60	724
WA	1	6	96	800	800
Total	**26**	**126**	**1077**	**9841**	**39709**

Year	#trees	%
1980's	278	13
1990	363	17
2000	878	42
2010	550	26

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Season 1 (2018/19)

Shot hole 72%

Lower limb dieback 70%

Hull rot 34%

Trunk disease 26%

Anthracnose 1%

Rust 1%

Scab <0.1%

Bacterial spot 1%

Blossom blight <0.1%

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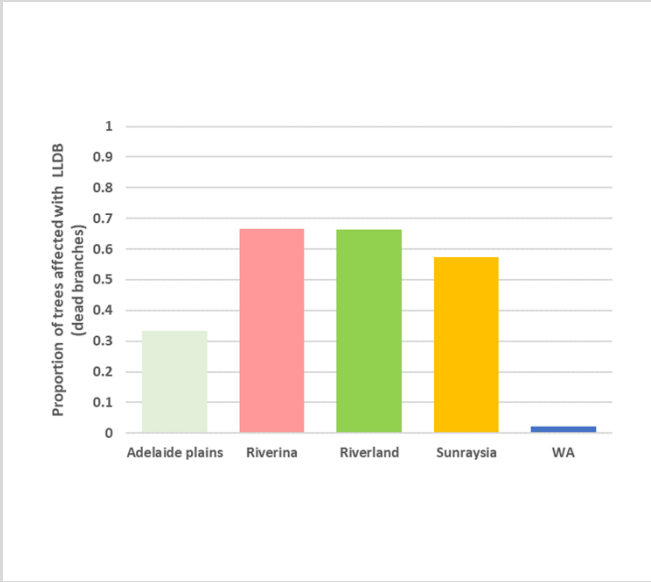

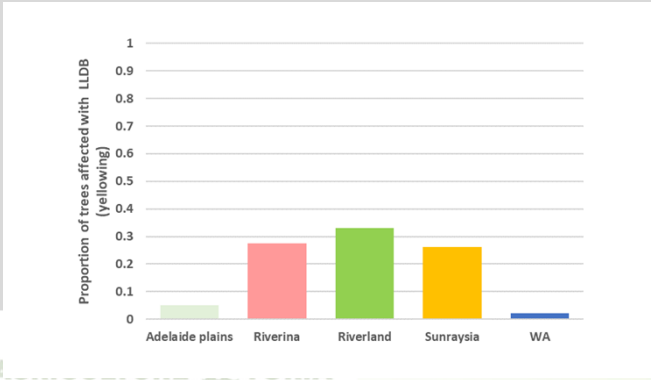

Regional differences: lower limb dieback

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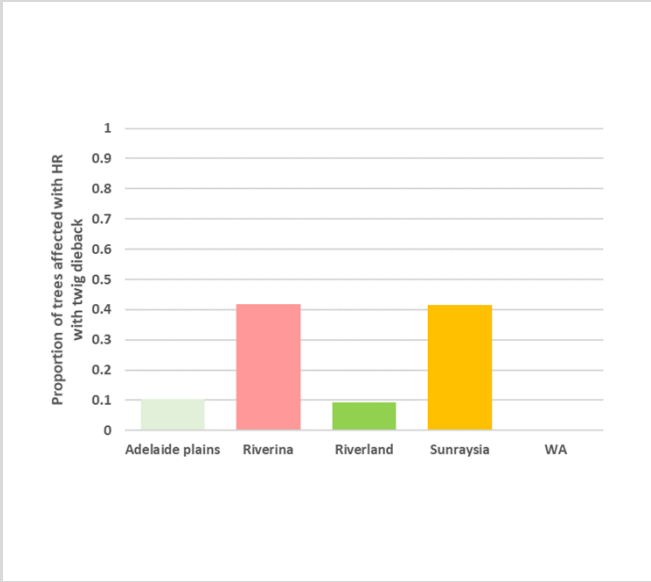

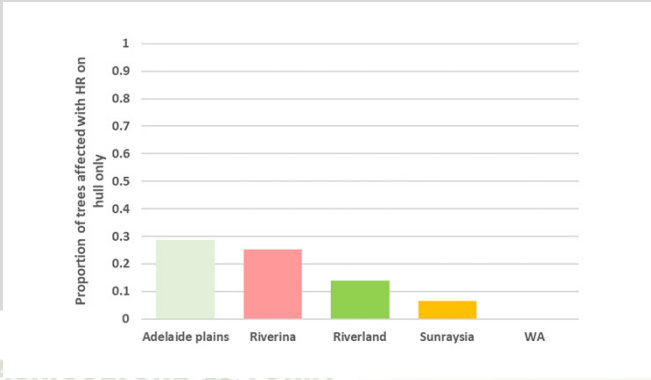

Regional differences: hull rot

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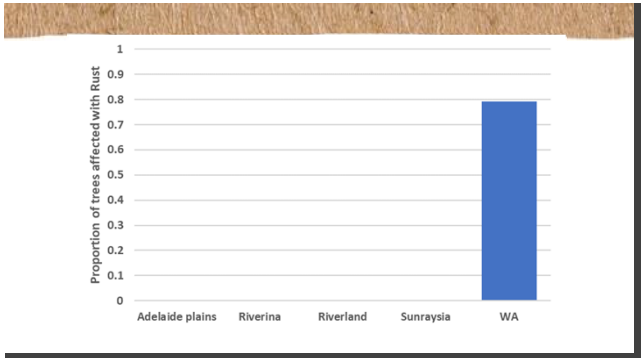
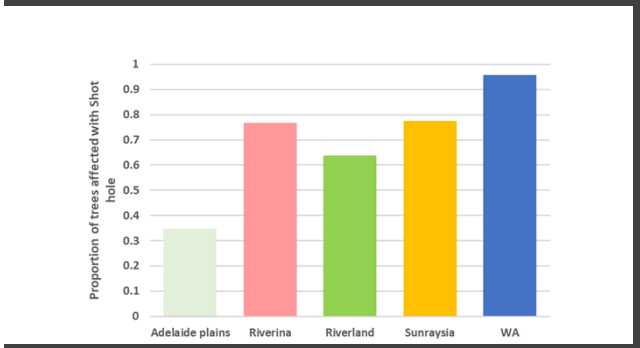
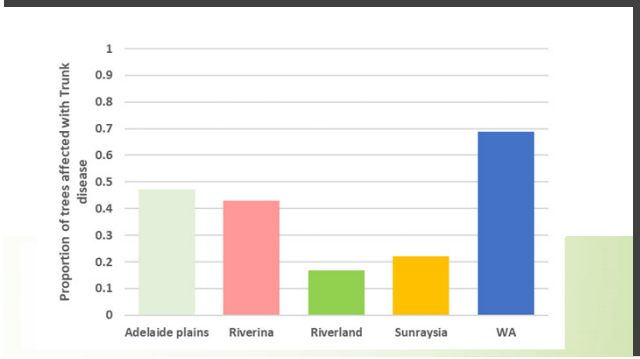
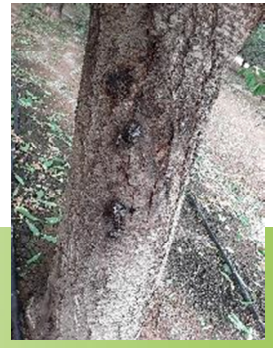






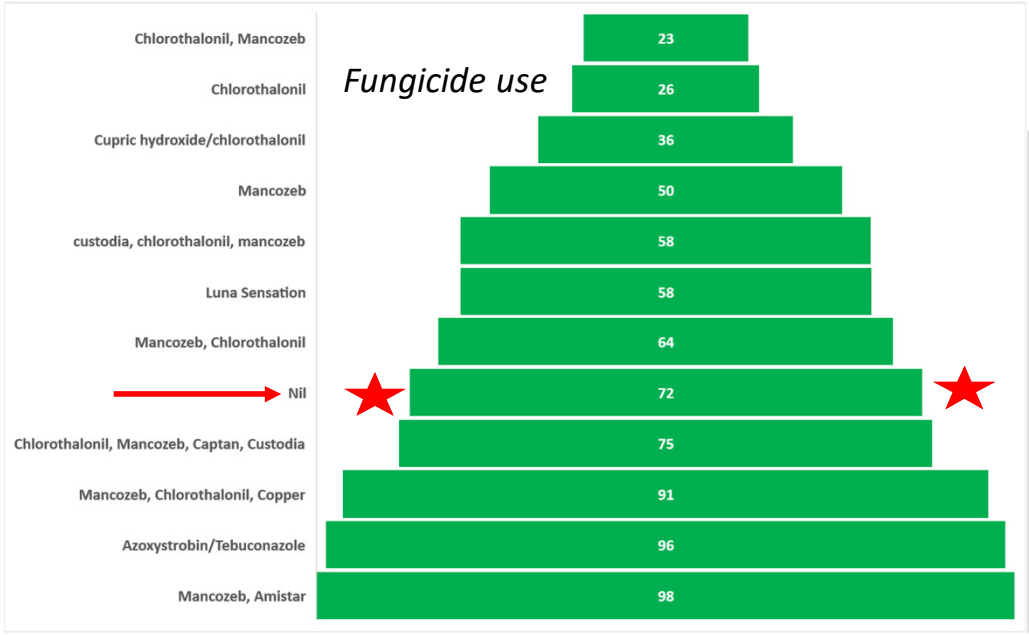


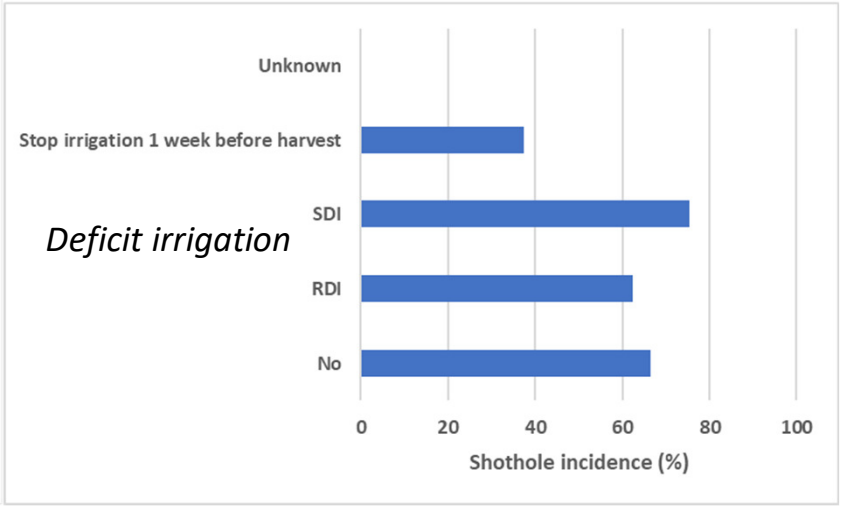
Regional differences:

rust, shot hole, trunk disease

Influence of agronomic practices on shot hole

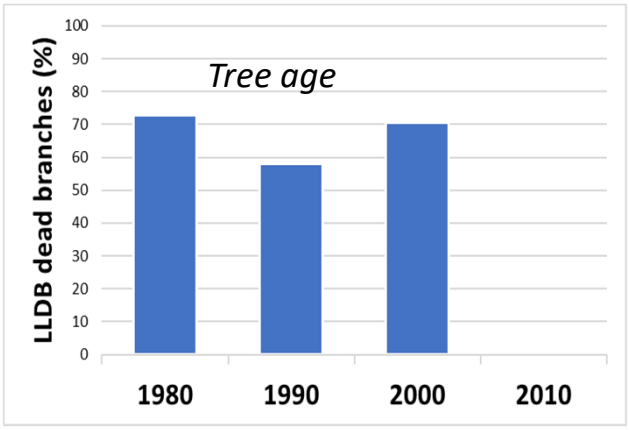
Term	Wald statistic	d.f.	chi. pr.
shot_hole_fungicide	190.9	11	<0.001
deficit_irrigation	34.4	3	<0.001

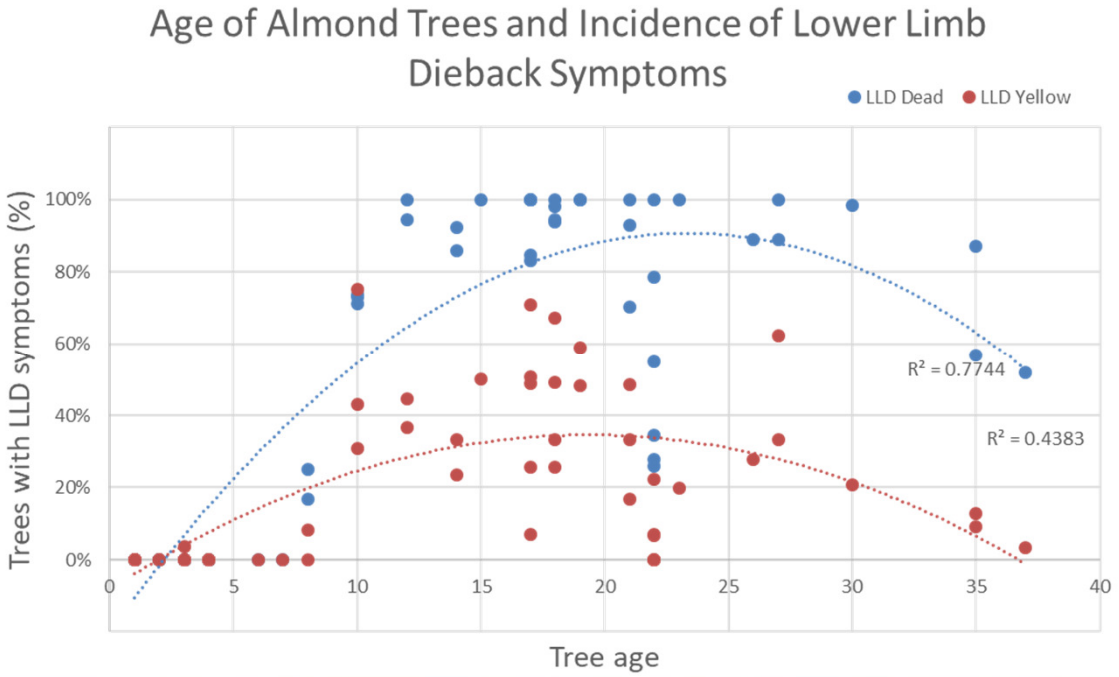




Influence of agronomic practices on lower limb dieback - age

Term	Wald statistic	d.f.	chi. pr.
Decade	132.61	3	<0.001
DPRain	105.63	11	<0.001
Variety	78.79	11	<0.001
deficit_irrigation	66.61	3	<0.001
Treespacing	40.52	1	<0.001
Irrigation	6.02	1	0.014





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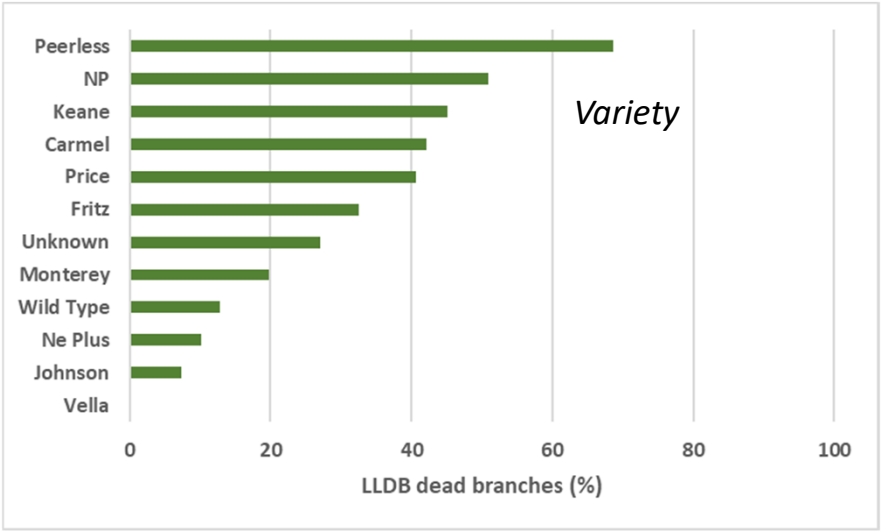
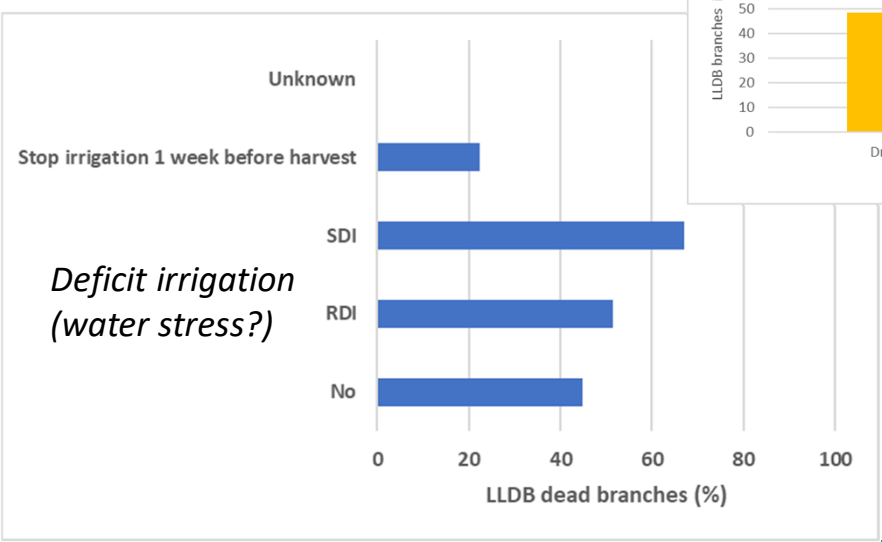
Influence of agronomic practices on lower limb dieback - variety

Term	Wald statistic	d.f.	chi. pr.
Decade	132.61	3	<0.001
DPRain	105.63	11	<0.001
Variety	78.79	11	<0.001
deficit_irrigation	66.61	3	<0.001
Treespacing	40.52	1	<0.001
Irrigation	6.02	1	0.014

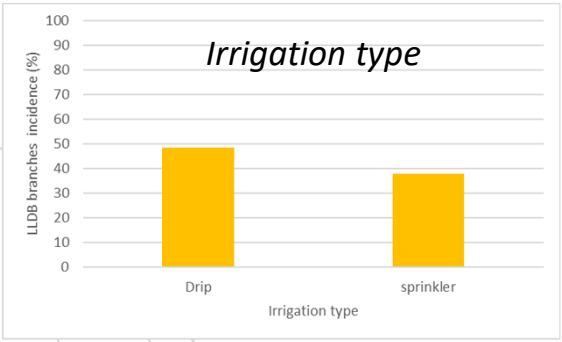


Influence of agronomic practices on lower limb dieback - water

Term	Wald statistic	d.f.	chi. pr.
Decade	132.61	3	<0.001
DPRain	105.63	11	<0.001
Variety	78.79	11	<0.001
deficit_irrigation	66.61	3	<0.001
Treespacing	40.52	1	<0.001
Irrigation	6.02	1	0.014



Deficit irrigation (water stress?)



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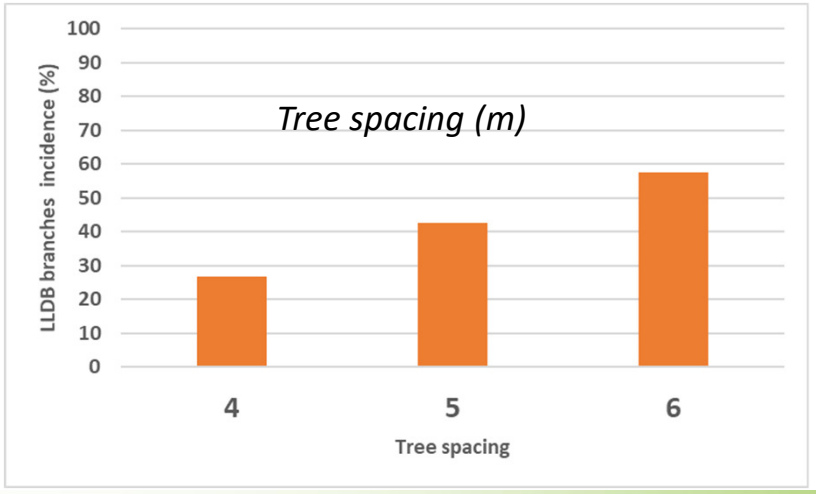
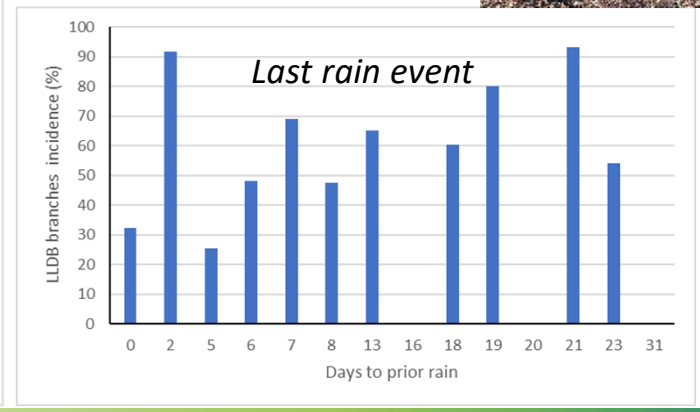
Influence of agronomic practices on lower limb dieback - other

Term	Wald statistic	d.f.	chi. pr.
Decade	132.61	3	<0.001
DPRain	105.63	11	<0.001
Variety	78.79	11	<0.001
deficit_irrigation	66.61	3	<0.001
Treespacing	40.52	1	<0.001
Irrigation	6.02	1	0.014





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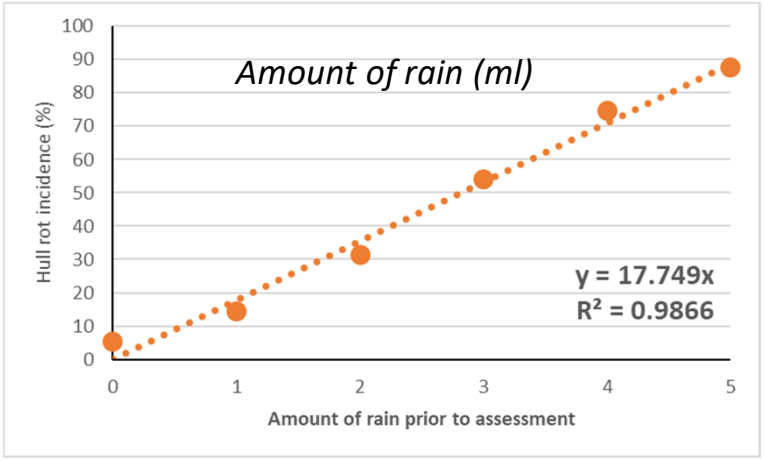
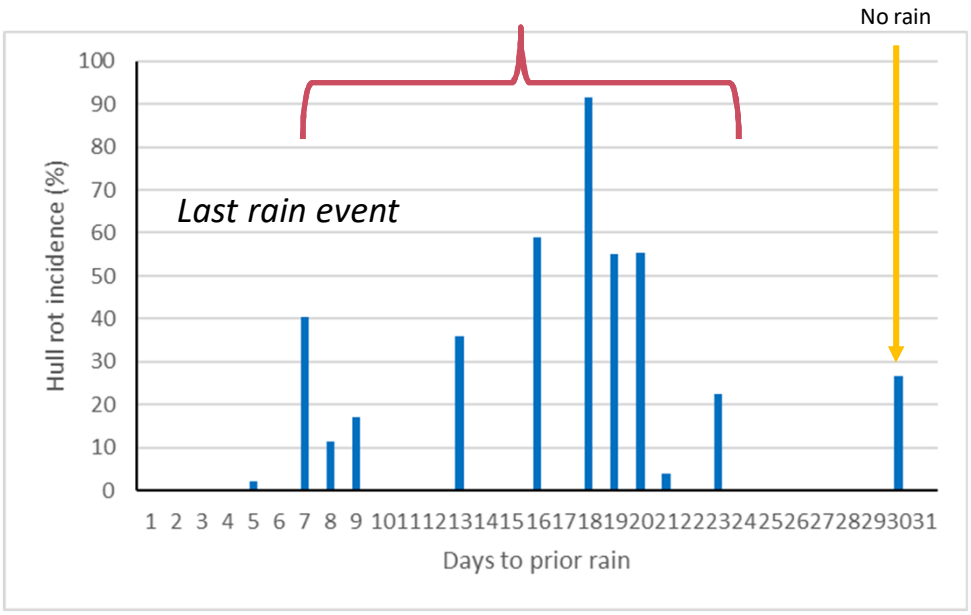
Influence of agronomic practices on hull rot (NP only) - rain

Term	Wald statistic	d.f.	chi. pr.
DPRain	51.27	14	<0.001
hull_rot_fungicide	28.64	4	<0.001
Amt_rain_ml	23.24	1	<0.001
Decade	22.81	3	<0.001
Root_stock	18.27	5	0.003
Irrigation	5.85	1	0.016





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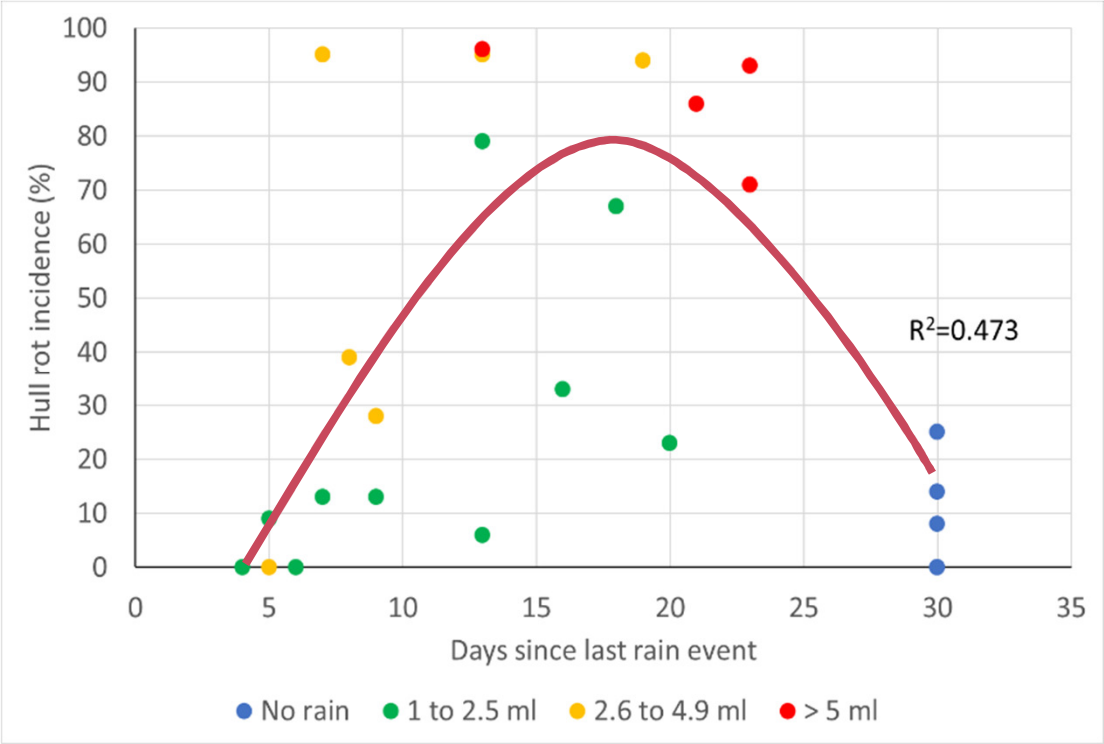
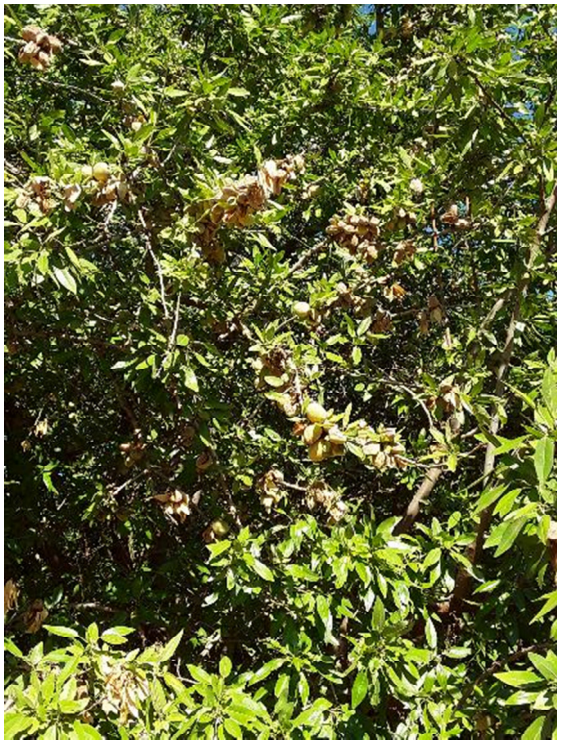
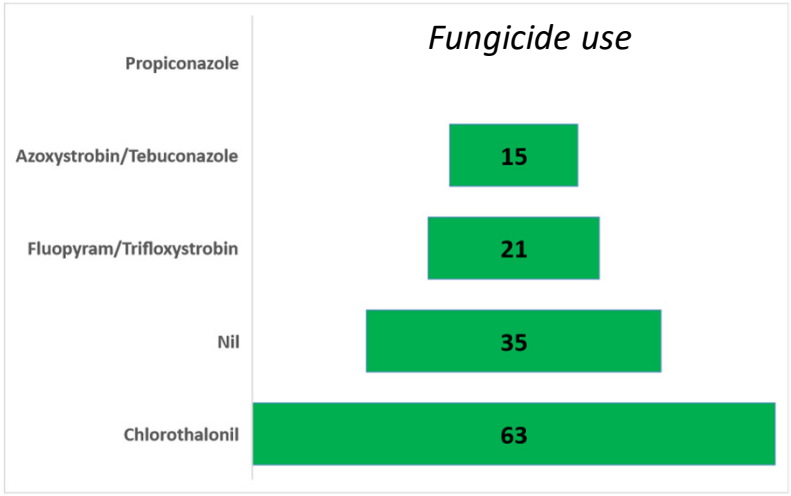
Combined influence of days since last rain event and amount of rain on hull rot

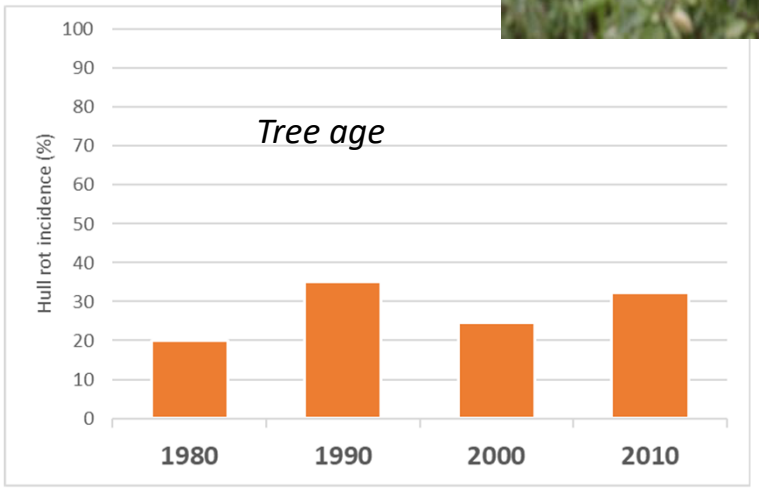




Influence of agronomic practices on hull rot (NP only)

Term	Wald statistic	d.f.	chi. pr.
DPRain	51.27	14	<0.001
hull_rot_fungicide	28.64	4	<0.001
Amt_rain_ml	23.24	1	<0.001
Decade	22.81	3	<0.001
Root_stock	18.27	5	0.003
Irrigation	5.85	1	0.016





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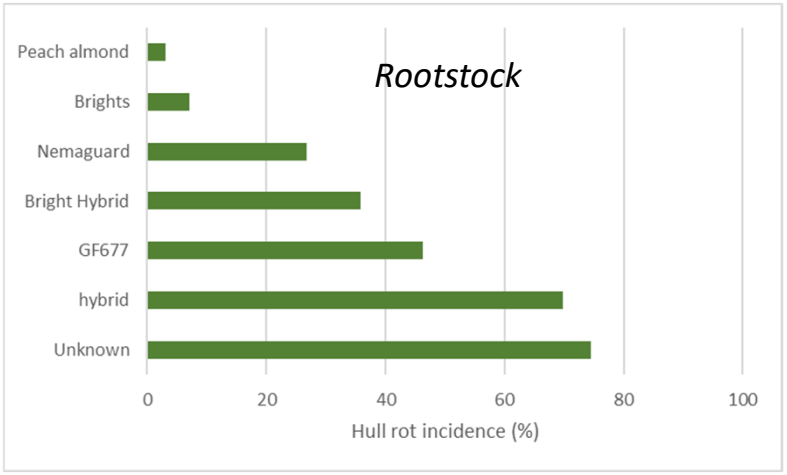

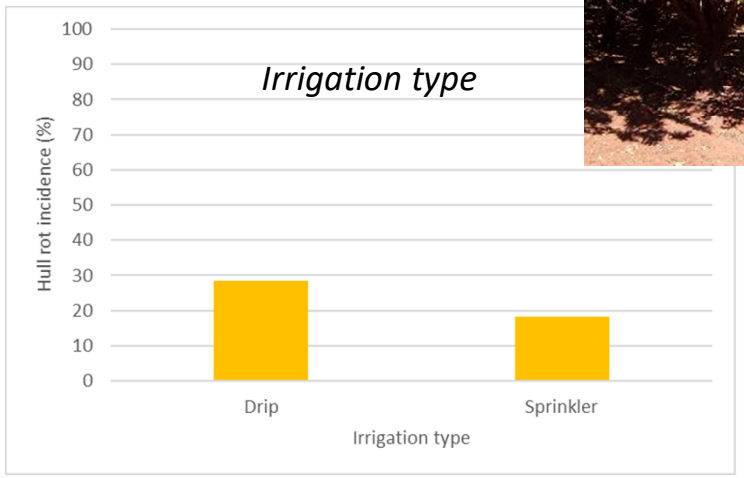

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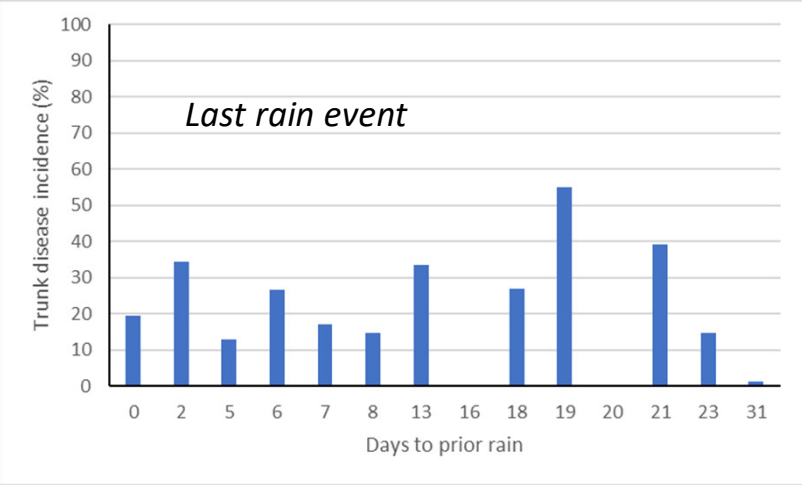
JE2

Influence of agronomic practices on trunk disease

Term	Wald statistic	d.f.	chi. pr.
DPRain	44.24	11	<0.001
Variety	40.63	11	<0.001
deficit_irrigation	34.12	3	<0.001
Rowspacing	25.93	1	<0.001
Decade	24.45	3	<0.001



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Slide 22

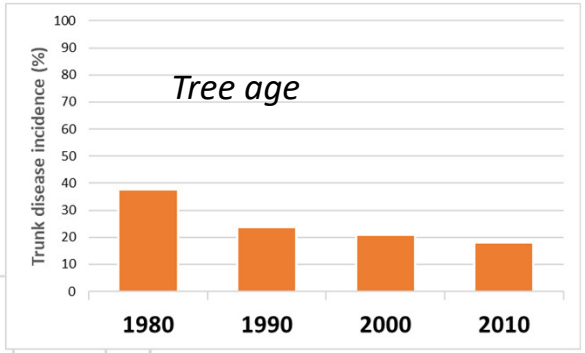
JE2 add row spacing

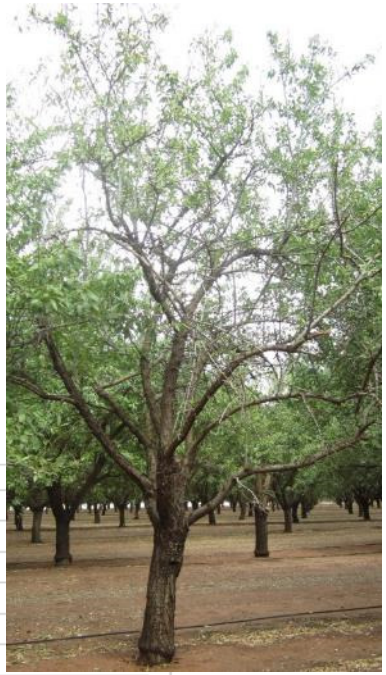
Jacky Edwards, 22/10/2019

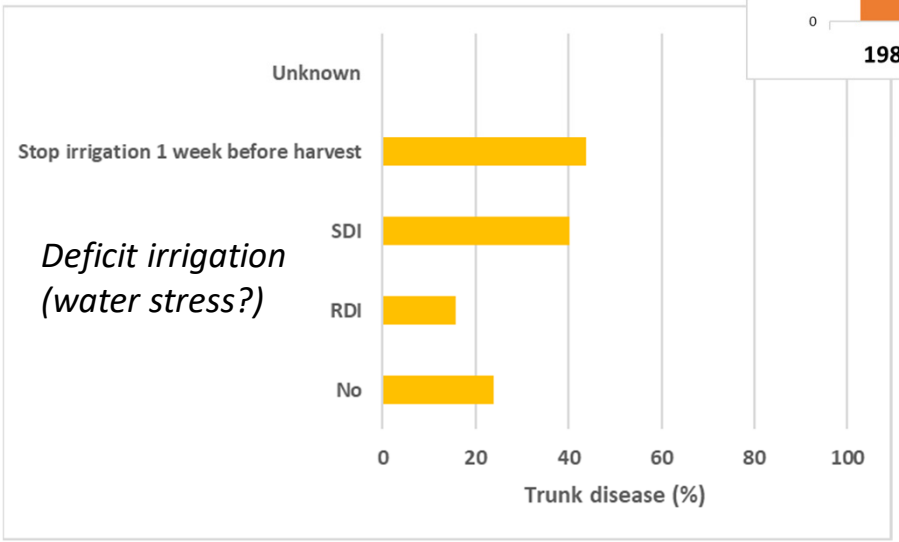
JE2

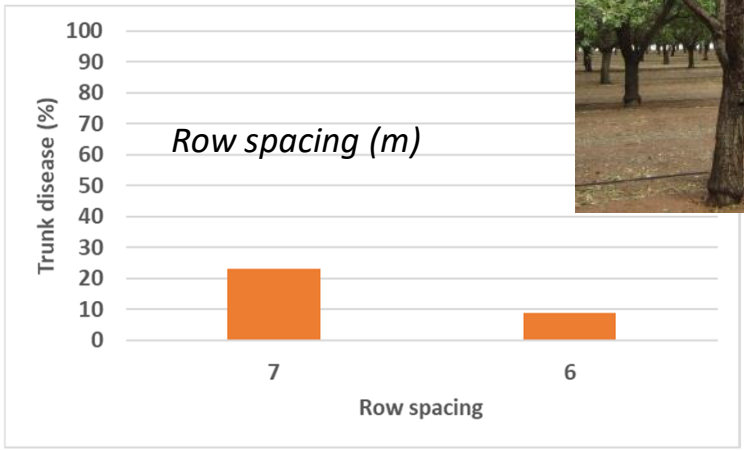
Influence of agronomic practices on trunk disease

Term	Wald statistic	d.f.	chi. pr.
DPRain	44.24	11	<0.001
Variety	40.63	11	<0.001
deficit_irrigation	34.12	3	<0.001
Rowspacing	25.93	1	<0.001
Decade	24.45	3	<0.001









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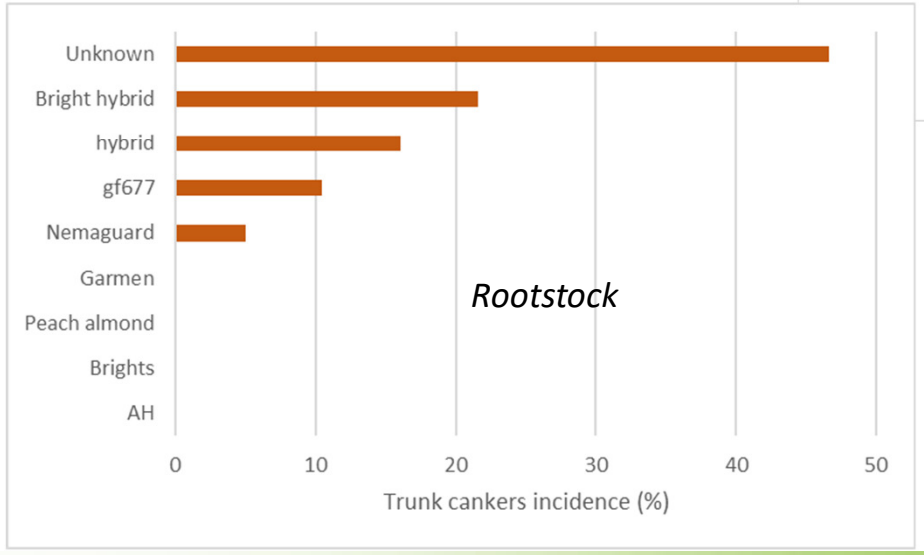
Slide 23

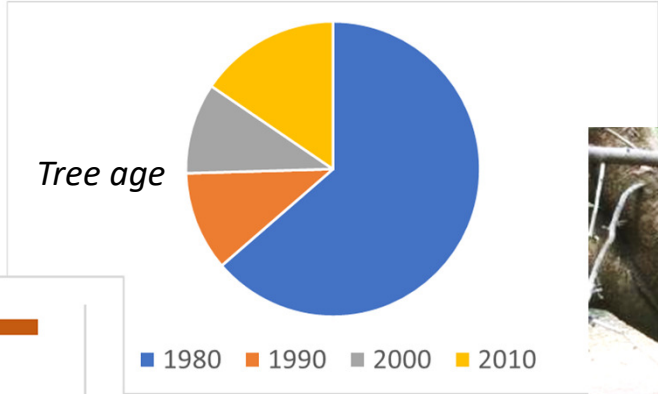
JE2 add row spacing

Jacky Edwards, 22/10/2019

Influence of agronomic practices on trunk cankers

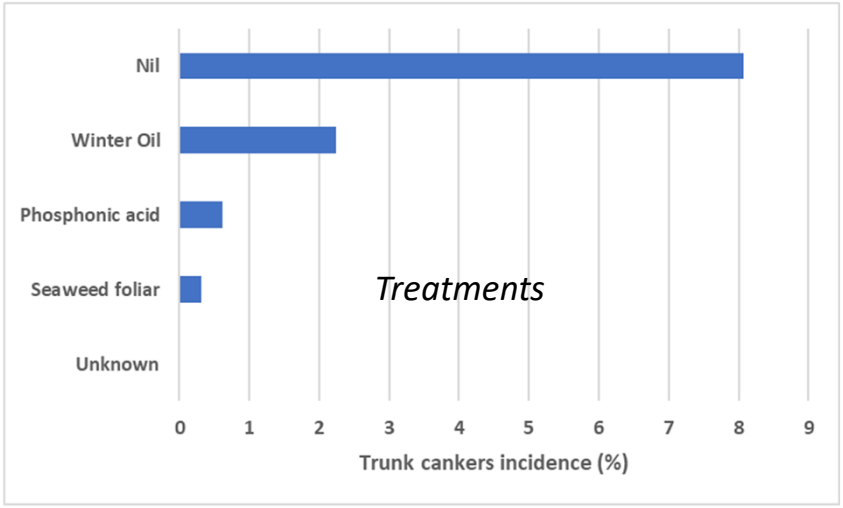
Term	Wald statistic	d.f.	chi. pr.
Root_stock	40.61	8	<0.001
Decade	27.14	3	<0.001
alternatives	19.42	3	<0.001
Rowspacing	13.76	1	<0.001

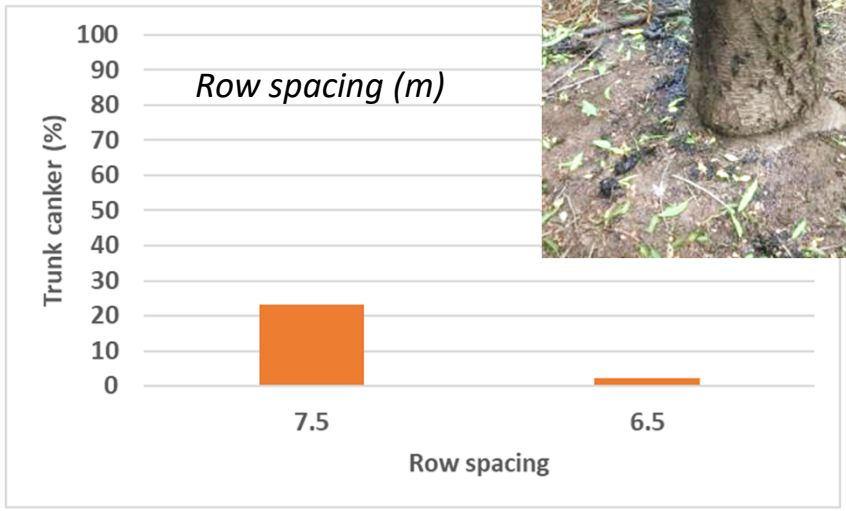




Influence of agronomic practices on trunk cankers

Term	Wald statistic	d.f.	chi. pr.
Root_stock	40.61	8	<0.001
Decade	27.14	3	<0.001
alternatives	19.42	3	<0.001
Rowspacing	13.76	1	<0.001

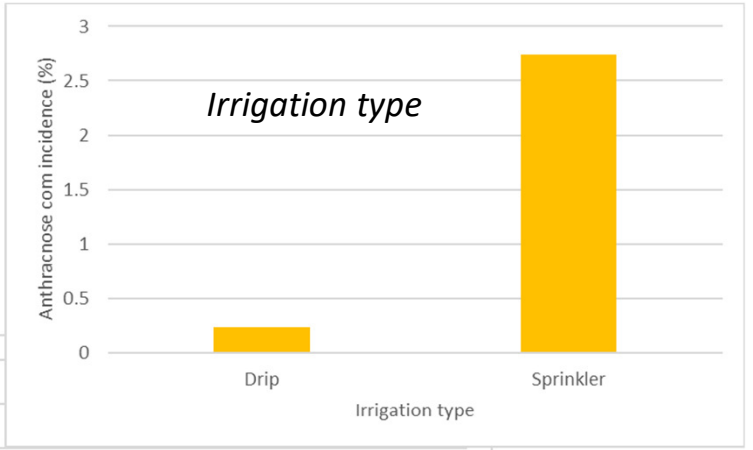


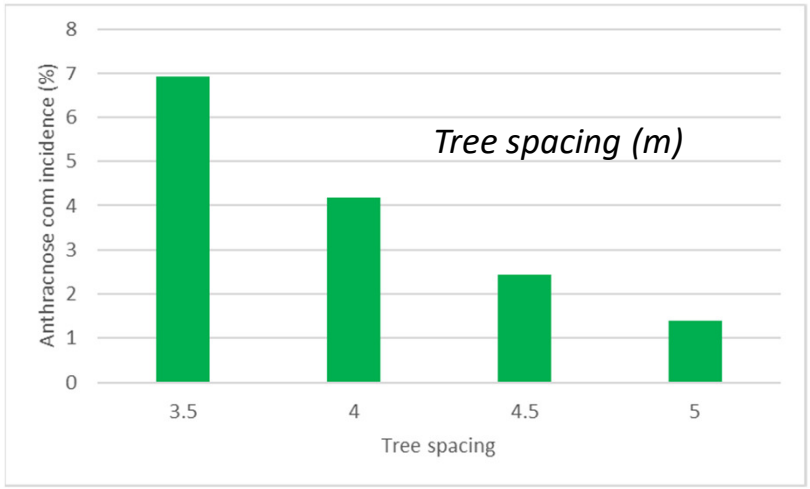


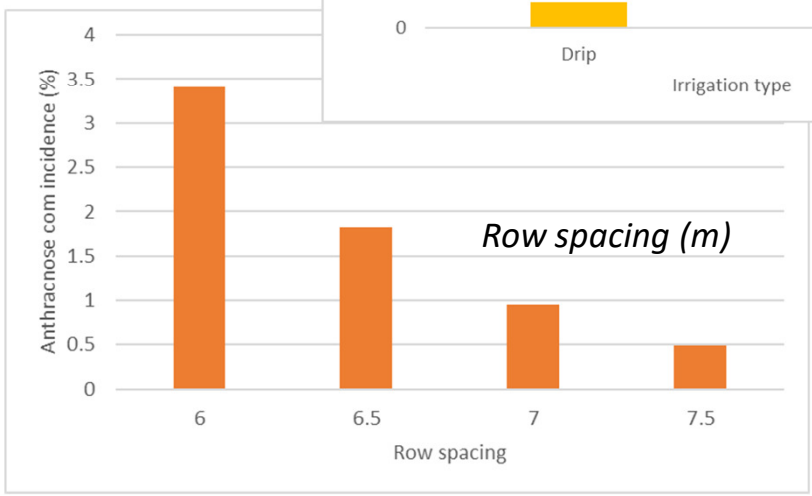
Influence of agronomic practices on anthracnose

Term	Wald statistic	d.f.	chi. pr.
Irrigation	16.85	1	<0.001
Treespacing	13.67	1	<0.001
Rowspacing	7.65	1	0.006

Anthracnose ✓







Influence of agronomic practices on disease

Disease	Factors order of significance
Shot hole	Fungicide, deficit irrigation
Lower limb dieback	Tree age, days from last rain event, variety, deficit irrigation, tree spacing, irrigation type
Hull rot	Days from last rain event, fungicide, amount of rain, tree age, rootstock, irrigation type,
Trunk disease	Days from last rain event, variety, deficit irrigation, row spacing, tree age
Trunk cankers	Rootstock, tree age, treatments, row spacing
Anthracnose	Irrigation type, tree spacing, row spacing

Hort Innovation
Strategic levy investment

ALMOND FUND