

Diseases (other than Phytophthora) and their management in avocado

Elizabeth Dann & avocado pathology team
Avoskills workshop, Manjimup, WA
11th March 2020

Fruit diseases

- anthracnose (not anthrax!)
- stem end rot
- pepper spot
- Cercospora
- Avocado sunblotch viroid



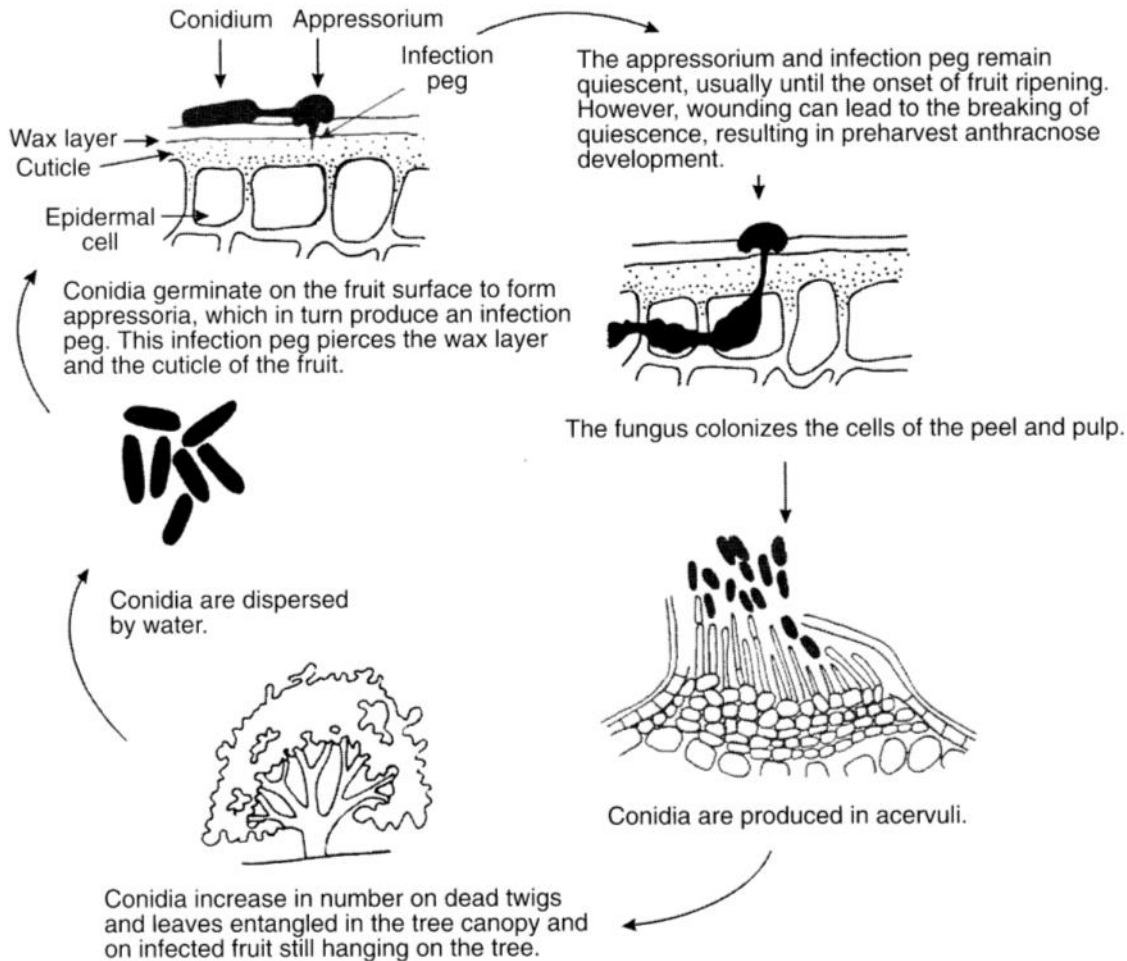
Colletotrichum spp. fungal diseases



Pink spores (conidia)



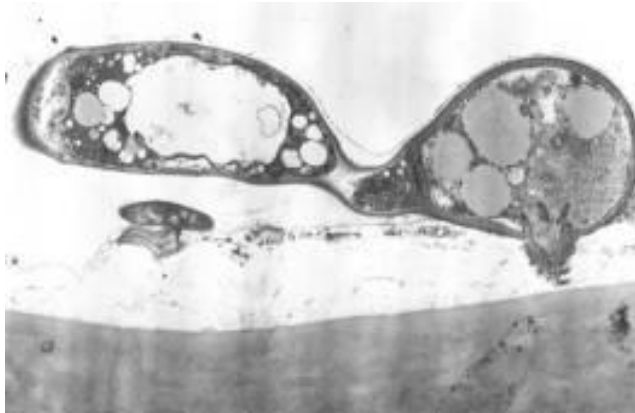
Anthracnose disease cycle



“Mummified” fruit are a source of spores for new infections



Colletotrichum infection process



Infection occurs in field from fruit set to harvest

dormant



period



Symptoms develop during fruit ripening



Mixed infection

Mummified fruit and disease occurs in other countries also (eg. Colombia)



Pepper spot

- Caused by *Colletotrichum spp.*
- Observed on fruit in the orchard
- Often associated with sunburn



Stem end rot (many fungi)

- *Colletotrichum* spp.
- Botryosphaeriaceae eg.
 - *Neofusicoccum parvum*
 - *Lasiodiplodia theobromae*
- *Pestalotiopsis* sp., *Phomopsis* (*Diaporthe* sp.)
- Endophytic infections occur within stem end, may switch to pathogenic during ripening
- Often worse in fruit from stressed trees – not much SER in fruit from field trials harvested Nov 2019



High proportion of *C. fiorinae* in WA in 2019

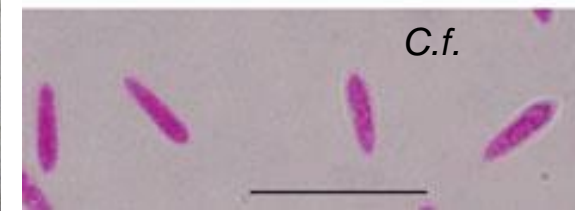
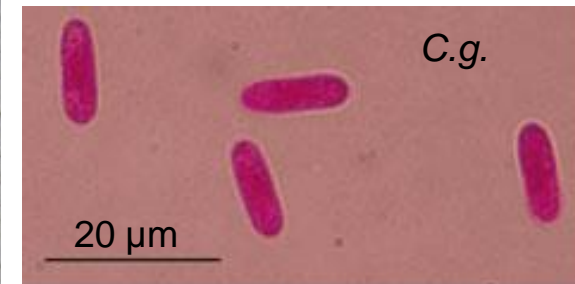
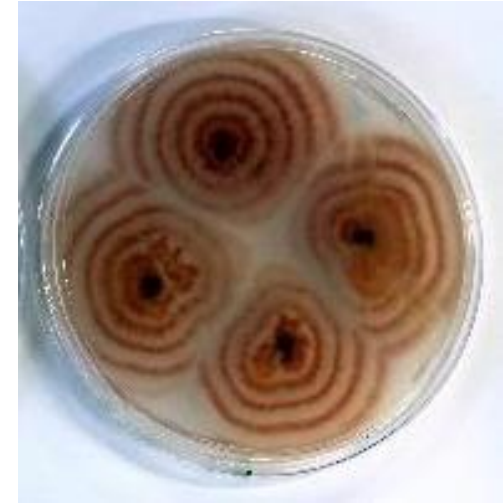
Colletotrichum fiorinae is a “cool climate” fungus

Total number of isolations from avocado fruit = 83

Number of *C. fiorinae* isolated = 54 (65%)

Number of *Botryosphaeria* isolated = 8 (10%)

Others (*C. gloeosporioides*, *Aspergillus* & *Fusarium*) = 21 (25%)



Managing fruit diseases

- Canopy management to allow airflow and spray coverage
- Orchard hygiene - remove dead branches, dieback limbs, mummified fruit
- Avoid stress, sunburn



Managing fruit diseases

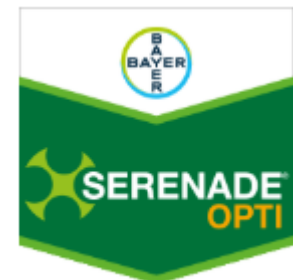
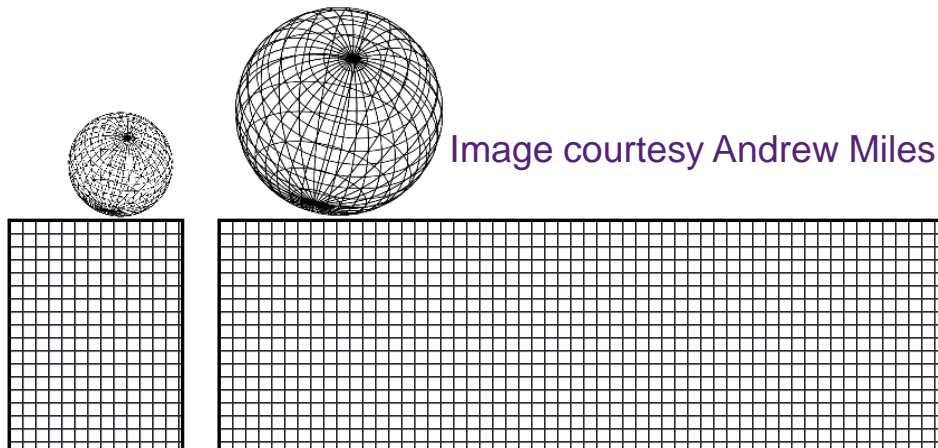
- Fungicide spray program - copper, azoxystrobin, Serenade Opti
 - *Be careful with Amistar*
- Correct nutrition (high N, low Ca exacerbates disease)
- Don't pick fruit in the rain
- Correct postharvest handling and fungicide



Fungicides

- Protectants

- Provide a defensive chemical layer on plant surfaces
- Typically inhibit germinating spores
- Eg. copper formulations, thiram
- Effective against a broad spectrum of fungi
- Target multiple fungal metabolic pathways, less chance of resistance
- Must be present prior to infection, no post-infection activity
- Regular applications necessary for thorough coverage
- Coverage is constantly eroded by weathering and plant (fruit) expansion



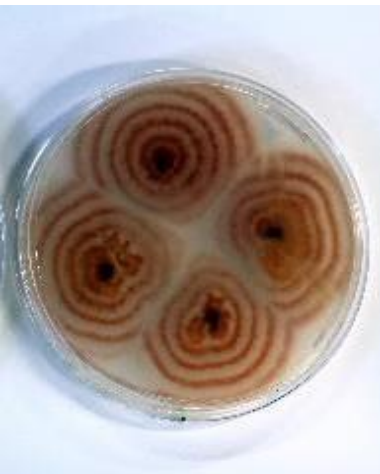
Fungicides

- Systemic (curative)
 - Enter host tissues and can be transported in the plant
 - Translaminar (eg. azoxystrobin) or fully translocated
 - Have post-infection activity
 - Inhibit various fungal functions, eg. germination, respiration
 - Often act on very specific (single gene) metabolic pathways in fungi
 - high chance of resistance developing in fungi
 - Strobilurins – block one point in energy production centre in fungal cell
 - More expensive than protectants
- Amistar (and generic azoxystrobins)
 - Strict anti-resistance strategy for application
 - Eg. no more than 3 applications
 - *follow the label directions !!*



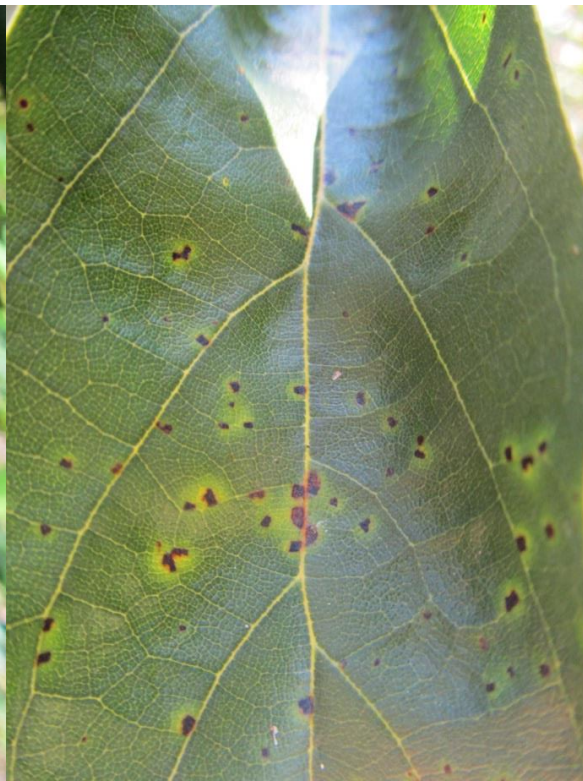
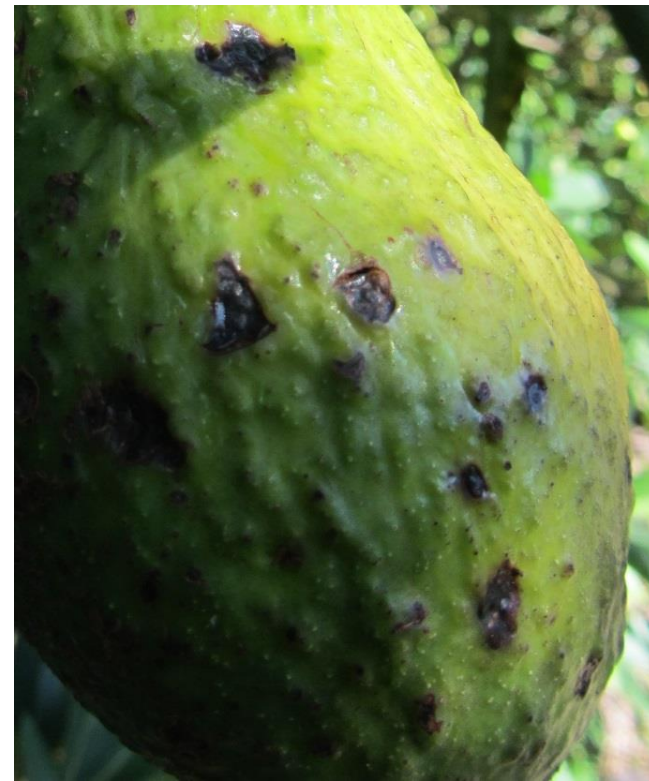
Key messages – anthracnose, SER

- Fruit are infected from early stages but you can't see it
- Canopy management, rejuvenation pruning essential
- Good coverage with fungicides important
- Pre-harvest azoxystrobin fungicide spray crucial
- *Fruit quality is the responsibility of **everyone** along the supply chain!!*



Cercospora spot

- Caused by the fungus *Pseudocercospora purpurea*
- Observed on fruit in the orchard
- Biosecurity relevance to NQ
 - *not present in other areas*
- Same management as for anthracnose



Avocado sunblotch viroid



- Uncommon in Australia (3 cases from eastern states in last 10+ years)
- Most likely from very old trees
- Please contact us if you see it

NOT ASBVd



Root diseases (other than Phytophthora)

- Black root rot
- Brown root rot
- Rosellinia white root rot

Black root rot



Black root rot of avocado – what do we know and how can we manage it?

Dr Louisa Parkinson, Dr Elizabeth Dann and Dr Roger Shivas

In this article we provide background information to black root rot disease, report some significant research and project outcomes, and outline some disease management options. The levy-funded project *Investigating tree mortality during early field establishment* (AV14012) is due for completion in the next eight months.

Black root rot

Black root rot is a severe disease of avocado nursery trees and orchard transplants and is caused by fungi in the Nectriaceae family. Rapid decline and death of young trees within a year after planting is typical, with above ground symptoms including tree stunting, leaf wilt, leaf drop, chlorosis and necrosis (Figure 1). Symptoms in the roots include black necrotic lesions along the feeder roots which coalesce to rot the entire root (Figure 2). Often black root rot can be confused with *Phytophthora* root rot, and when root necrosis is severe the two diseases are indistinguishable to the naked eye. However, infection by *Phytophthora cinnamomi* typically starts from the root tip, while black root rot lesions can form throughout the feeder root. Nectriaceous fungi also cause similar diseases of other crops, such as black foot disease of grapevine, collar rot of papaya and *Cylindrocladium* black rot (CBR) of peanut.



Figure 1 – Black root rot symptoms in young orchard transplants

Collecting and identifying fungi

“New” names for black root rot fungi of avocado

Prior literature reported some of the nectriaceous fungal genera as *Cylindrocladium* and *Cylindrocarpon*, and these genus names are well-known in the Australian avocado industry as important black root rot pathogens of avocado. With advances in gene sequencing technology and analyses of the lineage, as well as updates to fungal naming rules, genera have been reclassified and renamed.

“Cylindrocladium” is now more correctly known as *Calonectria*.

Cylindrocarpon now includes fungi in the *Neonectria*, *Ilyonectria*, *Cylindrocendrum* and *Dactylonectria* genera. However, so far we have confirmed that in avocado, only species in the *Dactylonectria* genus are pathogens. It is misleading to use the name *“Cylindrocarpon”*, and it is important that diagnostic labs around Australia are aware of these changes and have the information and tools required for correct diagnoses and identification.

“Cylindrocarpon” should no longer be used and laboratory testing is required to confirm presence of *Ilyonectria* or *Dactylonectria* in avocado roots.

genus level. In all, 153 fungal isolates were collected from 93 trees, comprising 74 avocado trees and 19 other hosts (including papaya, peanut, custard apple and blueberry), across all avocado growing regions in Australia.



Talking Avocados

Winter 2017 (Vol 28 No 3)

Pages 35-39

Same fungi, other crops



Black foot disease
of grapevine



Collar rot
of papaya



Cylindrocladium
black rot (CBR) of
peanut

Black root rot – cause and management



- Caused by fungi *Calonectria ilicicola*, *Dactylonectria* spp.
- Primarily from the nursery, although causal fungi can be isolated from mature trees
- Previous crops of grapevine with black foot may be problematic

Key messages – black root rot

- Buy trees from reputable nursery (ANVAS and/or NIASA accredited)
- Do not plant trees with black, sparse, unhealthy root systems
 - Nursery trees may look great, but roots bad
 - Inspect your trees in the nursery
 - Ask for a pre-dispatch health check
- Do not over-water or over-fertilise after planting



Plant trees with
clean, white
healthy roots

Phellinus brown root rot



Phellinus brown root rot



- Tropical/subtropical distribution
- Very wide host range, woody species
- Spread by root-to-root contact along row
- Infection “stocking” not always observed on trunk, but occurs on roots
- Survives in root debris for many years
- Managed by root barriers (quarantine)
- Do not spread infested woodchip/mulch



Rosellinia white root rot

- Affects apples, not common in avocado
- Spread by root-to-root contact
- Root barriers, fungicides (?)
- Have you seen it here?



Image: Andrew Manners, DAF



Image: Andrew Manners, DAF

Verticillium wilt



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Verticillium wilt in Western Australia in summer 2019

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By Dr Liz Dann

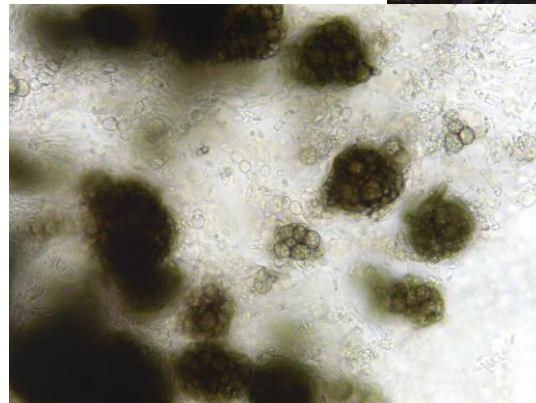
What is Verticillium wilt?

- Verticillium wilt is a fungal disease of avocado and a broad range of other crops including potato, tomato, grapes, stone fruit, nuts, cotton, strawberry, and some weeds including nightshade.
- The characteristic symptom is a rapid wilt of young trees, or single branches in older trees, followed by desiccation of leaves (*Figures 1 and 2*). Young trees may die.
- Streaky browning of the vascular system in young wilted stems about 1cm thick is apparent when a 1mm deep shaving is made with a sharp knife (*Figure 3*).
- Trees may recover, usually with warmer temperatures when growth of the fungus is arrested, and new vigorous growth may occur below the affected parts of the branch within several weeks (*Figure 4*).



Verticillium wilt

- *Verticillium dahliae* fungus survives in soil for many years
- Tomato, potato, grapevine, peanut are also hosts
- Streaky vascular discolouration



Verticillium wilt

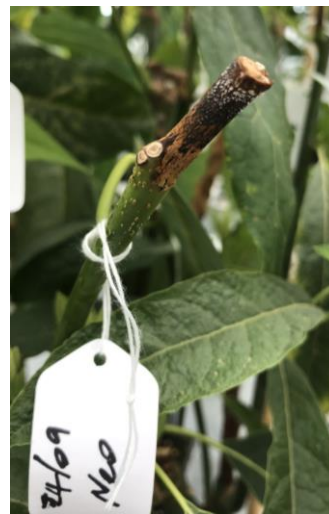
- Avoid planting straight after susceptible crops (**potato**, tomato, grapevine)
- Prune out and remove dead wood
- Delay major canopy management until warmer
- No fungicides available
- ?? Worse in new orchards with poor soil health
 - Cover crop with non-susceptible green manure before planting



Branch dieback



Branch, graft dieback



- *Colletotrichum*,
Botryosphaeriaceae,
Pestalotopsis etc.
- Fungi present as endophytes (internal), or infect through pruning wounds
- Worse in stressed orchards eg. hot, dry
- Canopy management and good orchard hygiene important
- Nurseries must use clean budwood
- Pruning wound treatments under evaluation (AV16007)

Beetle-vectored dieback

- First observed Sunshine Coast 2010
- Ambrosia beetle identified (also from macadamias nearby)
- Atherton Tablelands, 2011
- Now common Bundy/Childers
- 2+ fungi *Fusarium* sp., *Bionectria* sp.



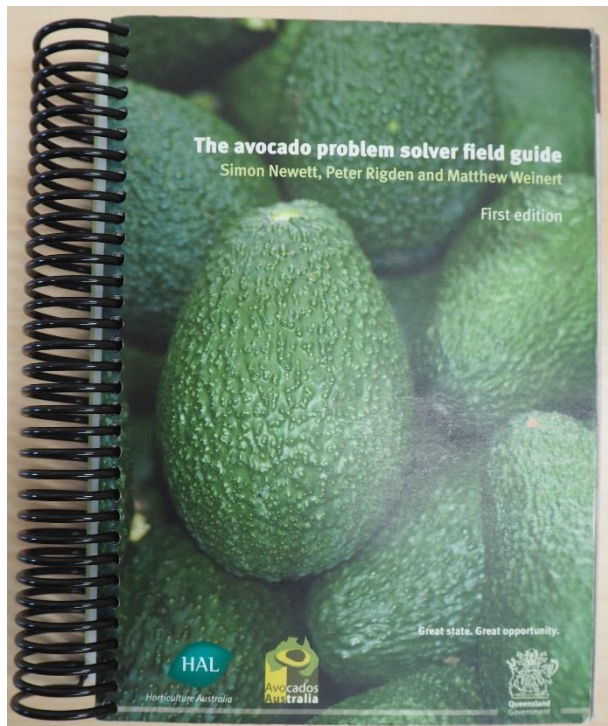
Beetle-vectored dieback

- Similar to Fusarium dieback in California and Israel, not seen in SW WA
- Wide host range of borers & fungi
- Early detection and removal of infested branches crucial
- Also observed in young trees
- Investigated in AV16010



Key messages – Branch dieback & Verticillium

- Canopy management and orchard hygiene is crucial – prune out and remove affected branches
- Improve soil OM and health to suppress Verticillium (and Phytophthora)
- Keep trees healthy and well irrigated during dry periods



Q'day, Elizabeth Dann

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The BPR is an online one-stop-shop focusing on best practice to improve the quality of avocados provided to consumers.

Avocados Australia welcomes new applications for the Best Practice Resource from all businesses that are part of the Australian avocado industry. This includes, growers, packers, wholesalers, ripeners, transporters, retailers, exporters, researchers, consultants, input suppliers and other relevant stakeholders. Information has been sourced from the latest research, development and industry investment, checked by industry experts and carefully structured to allow quick and easy access to information. Information and resources are updated as new content becomes available.

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Acknowledgements

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- Contact e.dann@uq.edu.au

**Hort
Innovation**
Strategic levy investment

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