

Final Report

Maximise the biosecurity of the Australia Citrus Industry Budwood Facility

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Delivery partner:

N/A

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CT17003

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Content

Content	3
Summary	4
Public summary	Error
! Bookmark not defined.	
Keywords	6
Introduction	6
Methodology	7
Outputs	12
Outcomes	12
Monitoring and evaluation	13
Recommendations	13
Refereed scientific publications	13
References	Error
! Bookmark not defined.	
Intellectual property, commercialisation and confidentiality	13
Acknowledgements	Error
! Bookmark not defined.	
Appendices	Error
! Bookmark not defined.	

Summary

Methodology/activities

This project aimed to increase the preparedness of the Australian Citrus industry for any future incursion of the Asiatic Citrus psyllid (ACP), and the accompanying disease Huanglongbing (HLB), by building a structure to house citrus budwood multiplication plants under insect proof conditions, thereby providing a source of HLB-free budwood to Australian citrus nurseries. The availability of HLB free budwood will be a critical factor in mitigating the spread of any future incursion of HLB, and in redeveloping orchards potentially removed as a result of a future incursion.

This project provided access to citrus levy payer funds through Hort Innovation of \$659,871.

Auscitrus provided additional funding of \$54,130 from retained surplus.

Auscitrus also provided in kind contribution via the Auscitrus Manager conducting all project management for the development, and Auscitrus staff providing general labour for some basic parts of the construction (e.g. floors, irrigation systems).

Problem statement

Due to a historically lower risk of an HLB outbreak in Australia it has been possible to maintain these supply trees in open orchard conditions, with routine testing. However, with the increased prevalence of HLB in neighbouring countries such as PNG, China, India and most of SE Asia, and increased pressure on our quarantine borders due to worldwide movement of people and goods, the risk of an HLB outbreak is greatly increasing.

For Australia to be ready for any future incursion of the ACP/HLB pest/disease complex, we must as a matter of urgency protect our mother trees from infection. The only scientifically accepted and practical way to do this is to grow the mother trees in insect proof conditions. By excluding the psyllid, we can exclude the disease, thereby providing a disease-free source of propagation material to Australian citrus nurseries.

The Australian citrus industry (through Auscitrus) did not previously have a facility to produce commercial quantities of propagation material under protected conditions, so to pre-empt any future incursion it was necessary to build an insect proof structure to house budwood supply trees. This structure must be in place before an incursion takes place in order to prevent the spread of the disease.

Key outcomes

The outcome of this project is a physical structure designed and operated to exclude ACP, while providing a suitable growing environment to produce citrus budwood tested free of HLB and endemic graft-transmissible diseases such as Citrus exocortis viroid and *Xyloporosis cachexia* of citrus. This provides an opportunity to increase the awareness amongst citrus nursery operators and orchardists of the importance of excluding HLB, along with the risks and repercussions associated with any future incursion. This will greatly enhance the biosecurity preparedness of the Australian citrus and citrus nursery sectors.

Awareness activities

A presentation was given to the Citrus Australia Technical Forum in Adelaide outlining the development and the need for protected budwood production. A tour of citrus growers through the almost complete facility was also conducted as part of this forum. A summary of the development was published in an Australian Citrus News article and enews.

A large part of the awareness activity will continue after the completion of the project via visits from nursery groups and growers seeing firsthand the advantages and challenges of growing budwood and nursery trees under insect screened conditions.

Future recommendations

Stage 2 of this development will double the floor area for budwood production and will be required to produce all of the industries budwood in the event of an HLB/ACP incursion. This should be constructed prior to an incursion,

as soon as the existing structure is settled, and any management issues associated with growing under screen are resolved.

Keywords

Huanglongbing, HLB, ACP, Insect screened budwood

Introduction

Australia is fortunate to be largely free of many of the debilitating citrus diseases prevalent in other parts of the world. This is due in a large part to the efforts of the not for profit industry organisation, the Australian Citrus Propagation Association Inc (ACPA, trading as Auscitrus) (Donovan 2016).

Huanglongbing (HLB or citrus greening disease) and (importantly) the Asiatic Citrus Psyllid (ACP) associated with transmitting the HLB bacteria, have swept through countries such as Brazil and the United States and are decimating their industries. HLB and ACP are present in neighbouring countries to our north such as PNG, China, India and most of SE Asia, with the potential for the psyllid to be brought to the Australian mainland via cyclones. ACP has been detected at our border protection points. The risk of an incursion of ACP/HLB is very real and must be taken very seriously by all sectors of the Australian citrus industry.

A cornerstone of HLB management in countries already dealing with this disease is a source of propagation material that is protected from the disease and its vector in an insect proof climate controlled horticultural structure.

Foundation trees of the major commercial citrus varieties are currently maintained in insect proof structures – forming the National Citrus Repository. There is redundancy provided by one tree of each variety held at EMAI, Camden, with a second tree held at Auscitrus, Dareton NSW. These trees provide the high health true to type bud source for the establishment of budwood multiplication trees. The building of the Dareton foundation screenhouse was partially funded under a Horticulture Australia project CT04022 in 2004-06. The ongoing maintenance and testing of foundation trees in the National Citrus Repository program is currently funded by project CT15005.

A Horticulture Australia/Auscitrus voluntary contribution project CT13705 enabled the Auscitrus Manager, Tim Herrmann, to travel to Florida and California in 2014 and visit several insect proof citrus nursery structures being used to exclude ACP following incursions in those regions. Recommendations from that project were:

1. All Australian budwood production should be moved into an insect screened facility as soon as financially and physically possible.
2. Accurate estimates should be prepared for several insect screening options, and the Auscitrus Executive should then decide on a suitable structure given the available funds.

The urgent need to develop a source of budwood under screen was reinforced by several international citrus nursery people who visited the Auscitrus site with the International Society of Citrus Nurserymen Congress, held in Mildura in 2017. This message was repeated by Nate Jameson, a citrus nurseryman from Florida who has experienced the devastation associated with ACP/HLB in his region, when he spoke at the Citrus Australia Technical Forum in Adelaide in 2019.

Methodology

The existing infrastructure at the Auscitrus nursery facility enabled budwood production but only the repository house was insect screened. A new and larger insect screened greenhouse has been constructed with the capacity to produce 500,000 citrus buds per year.

Note that this area under screen will NOT be enough to produce all the industries' budwood needs following an incursion. It has been designed to supply a reasonable proportion of the buds required (perhaps 50-70% depending on the season), but non-screened orchard trees will still be utilised in the interim. Consideration has been given to the planning of water and electrical supply and of the facility layout to allow for future expansion should the need arise, but more funds will be needed for expansion preferably before an incursion takes place. This project has developed the "core" of the budwood facility, with future expansion simply increasing the square meters under cover.

This insect proof structure has been integrated into the existing nursery complex on Auscitrus freehold land at 398 River Road, Dareton NSW 2717.

Overview

- Vacant land adjacent to the existing budwood structures was built up, compacted and levelled.
- A steel framed gutter connected greenhouse was built, 42m wide by 60m long, clad in inflated twin skin poly film, with insect screen installed over all openings.
- A pad/fan cooling system was installed to control the internal climate, necessary since the insect screen restricts air flow.
- A nursery industry standard (NIASA) plastic/gravel/weedmat flooring was installed along with drainage and drip irrigation systems.
- A new climate control computer was connected to the existing control system to control the cooling system.
- An insect proof atrium was built connecting the new structure to the existing greenhouse and shedding on the site, forming a complete insect proof workplace with restricted entry via insect locks (positive pressure vestibules).
- Existing greenhouses and attached shedding were sealed to exclude insects
- Irrigation pumps and electrical supply were upgraded to accommodate this new structure and future stage II structure.
- A 110kva three phase generator was installed and commissioned to supply back up power to irrigation and cooling systems in the event of grid power interruption.

Budwood trees propagated in preparation were potted on and moved into this new structure where budwood production will continue under insect proof conditions.

The Auscitrus Manager was responsible to design, plan, and coordinate the layout of the facility and the new structures, in consultation with the structure manufacturers, installers, and the Auscitrus Executive Committee. The Auscitrus Manager was supported by a Finance/Administration officer who was responsible for maintaining financial records of the development.

Experienced commercial companies were engaged to supply, construct, and commission the structure and associated components. These companies have had extensive previous experience with similar constructions. Companies are as follows:

- Structure and coverings – Redpath Pty Ltd
- Pad/fan cooling system – Munters Pty Ltd
- Installation of structure, coverings and cooling systems – Forest Reach Pty Ltd
- Electrical Works – RDG Electrical
- Floors, drainage, irrigation system – Auscitrus staff
- Earthworks – Waters Excavations
- Sealing of existing shed – GeeBee Plumbing

Auscitrus staff and casual labour were engaged to install the irrigation components, and to carry out basic unskilled support labour associated with the construction.

Initial plans called for moving all existing plants out of the existing shadehouse into the new greenhouse. Logistically this proved difficult, as a temporary standing ground would have been required. A future stage II greenhouse was in the plans, so this screenhouse was built where the stage II greenhouse was to be built, allowing the shadehouse to remain temporarily. Stage II will now replace the shadehouse structure when it is built. As such, trees could be left in the shadehouse while this new structure was being built, greatly reducing the labour requirement. Funds allocated for moving trees was instead allocated to site preparation at the stage II location, and additional irrigation that was to be reused from the shadehouse (which will now be used in stage II).

Several items were over budget due to on-the-fly decisions (authorized by the Auscitrus board) to upgrade from the original plans (e.g. concrete paths instead of gravel) – budget over-run was covered using Auscitrus retained surplus funds.

Entire complex insect proof and operational



Figure 1- New structure on right of picture – existing shadehouse (centre) will be removed to make way for Stage II development



Figure 2 - Atrium connecting new house to existing structures



Figure 3 - cooling pads under insect screen in central atrium – stage II screenhouse will be attached to right of this picture



Figure 4 - positive pressure insect lock – all personnel enter through this vestibule



Figure 5 - budwood multiplication trees in new greenhouse



Figure 6 - Citrus Australia Technical Forum grower tour of facility

Outputs

- Program logic, monitoring and evaluation plan linked to Hort Innovation and industry/fund objectives
- Project risk register and management plan
- Stakeholder engagement/communication plan
- A significant proportion of budwood production (about 50-70% of total demand) under insect proof climate-controlled conditions on par with international practice of countries that are battling HLB/ACP.
- Plans and infrastructure in place to rapidly expand insect screened production area in case of an incursion
- A maintenance and monitoring protocol for operation of the budwood facility
- Australian Citrus News articles describing the project and developing grower awareness of the need to use budwood tested for HLB and other graft-transmissible pathogens.
- Grower field day to showcase the insect proof structure
- A project overview and the reasons for its development presented at Citrus Australia technical forum and in annual reports to Citrus Australia and Hort Innovation.
- 6 monthly milestone reports detailing progress and a final report detailing the final outcome

The availability of an insect screened budwood facility will strengthen the biosecurity message in all ongoing future communications with growers and nurseries and will provide an ongoing reference regarding the management of citrus trees under insect screens extending beyond the duration of this project.

Outcomes

- Increased industry awareness and preparedness for incursion of Asian Citrus Psyllid (and HLB).
- A significant proportion of the Australian Citrus industry's budwood scheme protected from ACP and HLB using current best-practice methodologies, with infrastructure in place to move 100% under screen when required (subject to additional funding).
- Improved grower understanding of best management practices under an insect exclusion environment
- Improved biosecurity practices in nurseries producing citrus trees
- Industry observation and awareness of options for establishment of insect exclusion structures

Monitoring and evaluation

A Gantt chart was developed to chart a timeline for the project.

Detailed budgets were developed and monitored through each critical project stage. Project was delivered within budget, with extra modification costs absorbed by Auscitrus.

A logic monitoring and evaluation plan was developed and presented in Milestone 102.

Recommendations

Efforts to encourage the use of tested budwood grown under insect screened condition should be continued and where possible strengthened. A coordinated approach between Auscitrus, Citrus Australia and the nursery industry would best ensure the optimal uptake of the outputs from this project. This new structure will on a long-term average supply 50-70% of industry budwood requirements, with the focus being on high priority industry varieties. Planning should be put in place to expand the insect screened production area to twice the current floor area (total of 5000 square metres) prior to an incursion of HLB/ACP. Industry demand varies between 500,000 and 1,000,000, with the demand steadily at 1,000, 0000 in the last 2-3 seasons. Demand is drop back to 7-800k in a year or two.

If we have an incursion and budwood from the Auscitrus scheme become compulsory, it will possibly be 1-1.5M buds per year but we can't know for sure.

Please note that 500,000 buds per year is a conservative estimate. The current structure will hold approx. 12,000 trees, at 50 buds per tree per year that's 600,000, but we usually get well over 50 buds per tree per year. It's highly variable, dependent on variety and timing of demand - we will get better at optimising bud supply as we get more experience in this structure.

A workshop is planned to target the citrus nurseries around August 2020. Part of include a tour of the facilities and showcasing how the new structure is being used effectively to create a sterile environment.

The workshop will also include technical techniques on how to grow and manager nursery plants.

Refereed scientific publications

None

Intellectual property, commercialisation and confidentiality

No project IP, project outputs, commercialisation or confidentiality issues to report

Appendices

- Appendix 1: Australian Citrus News article
- Appendix 2: Citrus Australia 2019 Technical Forum presentation

New Auscitrus screenhouse a “game changer”

Auscitrus has strengthened its capacity to protect the nation’s budwood supplies from disease, focusing specifically on any future incursion of HLB, with the completion of its new protective screenhouse.

Grower levies, through Hort Innovation, funded the new climate-controlled structure, which will house budwood trees under insect-screened conditions, ensuring a source of HLB-free budwood for Australian citrus nurseries.

Supply trees at Auscitrus have been traditionally maintained in open-orchard conditions with routine testing but an increased prevalence of HLB in neighbouring countries and greater pressure on Australia’s quarantine borders mean the risk of an HLB outbreak has grown. HLB poses a significant threat because it can be transmitted by an insect vector, as well as in budwood.

The availability of HLB-free budwood is seen as a critical factor in mitigating the spread of any future incursion of HLB, and in redeveloping orchards potentially affected as a result of this.

Auscitrus manager Tim Herrmann described the new facility as a “game changer”.

“All varieties in the future will be grown in pots under screens and we’ll slowly phase out the trees in the field, so we won’t have anything exposed to insects in case we were to get HLB or the Asian Citrus Psyllid in the country,” Mr Herrmann said.

“We hope we never do, and that we never actually need the new facility, but we will be ready if it ever does arrive.”

Mr Herrmann designed the new facility after he and the Auscitrus committee travelled extensively through countries that have installed similar facilities in response to an HLB incursion, including the USA, South Africa, and Brazil.

The plans were revised “over and over again” based on information gathered from each visit.

Key points

- ❖ New protective screenhouse completed
- ❖ Clean budwood grown inside
- ❖ Growers should insist on clean material

“For some time we’ve had an insect-proof foundation repository for our mother trees, this holds one tree of every variety (a second tree is in a separate facility at EMAI). We integrated that existing structure into our new insect screened complex.”

The existing buildings have been linked to the new growing areas with an insect proof atrium.

The majority of the structure is a standard steel frame commercial

nursery structure with twin skin polyethylene on the roof and walls. Cooling pads are installed on one side of the structure and large extraction fans are used to extract the heat.

“We decided not to put roof vents in because they are too hard to insect proof,” Mr Herrmann said.

“All the fans and cooling pads in any area that has to be kept open for ventilation are covered in quarantine-standard insect screen to exclude any insects .

“Where we come into the building rather than having a single door there’s now a sealed double door entry way with positive pressure fans so when you open the door the air blows out past you.

“All staff go through foot baths and hand sanitising procedures. They then go through another door before entering the actual growing area.” Each of the growing areas are also sectioned off with a sliding door.



Auscitrus manager Tim Herrmann in the propagation house in March (just before the structure was completed).



A drone image of the new facility.

All staff have a set of five uniforms – one for every day. When they enter different growing areas there’s a dust coat specific to that growing area so they’re not transitioning pests.

The new facility will be heavily restricted to visitors but special visitors can see everything from a central atrium without having to enter different areas.

“I need to reinforce that we don’t let people into areas where they could compromise the biosecurity of our trees as that would defeat the purpose of what we’re doing.”

The new screen house is capable of producing one million buds annually but Mr Herrmann said double this amount would need to be grown to supply industry demand if there was an incursion.

“The structure has been built with the idea that we will double the size of it in the next 3-5 years,” he said.

“All the infrastructure needed for expansion is already in place. All we need to do is build another base structure, with covers, floors and irrigation.”

Mr Herrmann said development in stages has other benefits.

“We will phase out our current trees over the next two years and have all clean budwood in place before we build the next structure.



Cooling pads in the new facility.

“It’s also going to be quite a strong learning experience in growing budwood in the new facility. We’ve been growing budwood out in the field for 52 years but growing under screen presents a number of new problems. We’re looking forward to the challenge.”

Mr Herrmann said the structure has been funded through grower levies but the operations of the not-for-profit Auscitrus budwood scheme are self-funding through seed and budwood sales. As a not-for-profit all funds must go back into the scheme, and a significant amount of retained surplus

has been poured into this development to supplement the levy funded project.

“Growers need to use it. It’s voluntary to use tested material, but if growers aren’t insisting that nurseries use clean material, then the investment the industry has made may be wasted.

“We hope that once we have the capacity to supply everyone’s needs, all growers will look for tested material and use it.” ●

Securing our budwood supply

Levy funded project CT17003

Maximise the biosecurity of the
Australian Citrus Industry Budwood Facility

Purpose

- Budwood historically grown outdoors
- Tested regularly for graft transmissible disease
- No protection from insect borne disease



Risk analysis

- Insect vectored disease could infect budwood blocks
- Result = no clean budwood source for nurseries
- Low Probability (?) but High Impact







25,000 trees = 1.25M buds per year



50,000 trees = 2.5M buds per year



100,000 trees = 5.0M buds per year















Screenhouse operations

- Phase in over next 3-5 years
- Trees cut for 5 years then discarded
- Randomised indexing and fruiting
- Barcoding



Clean budwood



Clean nurseries



Clean orchards



Auscitrus

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