

# SOILLESS AUSTRALIA

Protected Cropping Australia Industry Trade Magazine



## Micro-drones get buzzing

THE COST OF  
PREPARING FOR  
SPOTTED WING  
DROSOPHILA

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Hanging Gardens  
of Babylon found!

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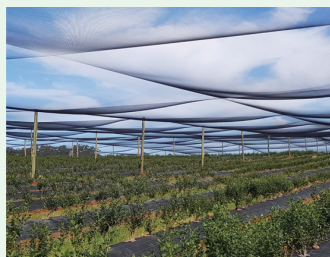
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## FRONT COVER

Micro-drones can assist with pollination in greenhouses.  
CEO of Polybee, Siddharth Jadhav, demonstrates a micro-drone in a tomato glasshouse.  
See more on page 10.



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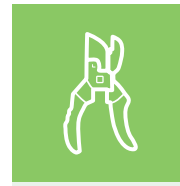
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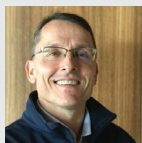
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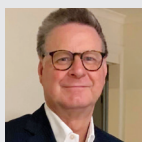


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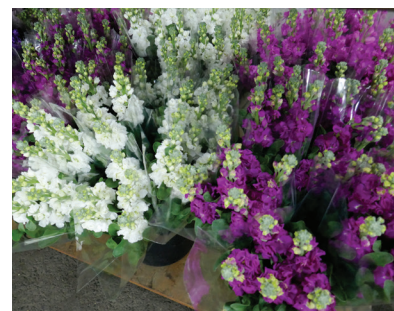
This issue features the benefits of technology from the use of micro-drones to aid pollination in greenhouses as shown on our cover this month (see more on page 10), to the triumph of AI over traditional growing in the recent Autonomous Greenhouse Challenge (AGC).

This year's challenge, the third, was to grow a marketable crop of lettuce managing the crop remotely. Find out who won and why on page 9. For more information, watch the online presentation on Wageningen University and Research's Youtube channel.

The teams noted that crop spacing was the biggest challenge they faced. At times they also failed to deal with high light levels. They needed Tony Bundock on hand! Tony, who is the Deputy Chair of PCA and an expert in hydroponic growing, has agreed to take over our informative Nitty Gritty column to address technical issues in hydroponics and undercover growing. His first column is on climate control and how to get the balance right between heating and cooling (see more on page 33). He concludes that times have changed dramatically due to today's technical aids compared to when it was a matter of hand opening vents in greenhouses.

Also nimble at adapting to change are the flower growers profiled in this issue – brothers Sam and Phil Dominello from S & P Dominello, a family-owned farm at Peats Ridge north of Sydney.

They share their story, including the ups and downs of the business, with cut flower expert Bettina Gollnow. The local cut flower industry has suffered over the past decade or so due to the ready availability of imported flowers. The arrival of COVID halted imports so buyers turned to local growers. Discover their story on page 17.



*Meet the growers who grew these stocks on page 17.*

## Old and new technology

This issue also includes a final article from Rick Donnan, who addresses the true identity of the Hanging Gardens of Babylon and asks was it an early example of hydroponic growing? I won't spoil the story, which begins on page 28, but the garden was a technological marvel.

While it's been hard to find the Hanging Gardens of Babylon on a map, the same can't be said for the protected cropping industry in Australia now PCA's mapping project is underway. Catch up with this major project on page 22.

Still on the trail of new technology, is a report from a recent field day at the Carnarvon Research Station in the Gascoyne region in Western Australia. As well as trials with capsicum, tomato and zucchini, researchers have jackfruit and persimmon under trial with a twist (see page 26).

PCA's Executive Officer Sam Turner has hit the ground running. He has been out and about meeting PCA members around the country. See where he's been and what's on his desk in his new regular report on page 8.

## Jennifer Stackhouse, Editor

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## Seeing purple for health



Blueberries are part of a trial on the benefits of a purple diet to prevent cognitive decline.  
Photo Adobe Stock Photos

Researchers believe a 'purple diet' can help prevent cognitive decline. University of Wollongong nutritional epidemiologist Professor Karen Charlton will lead a research project, incorporating purple-red foods like blueberries and cherries into the diet of people at risk of dementia.

Foods with a deep red, purple or blue colour contain anthocyanins, a bioactive compound with strong anti-inflammatory and antioxidant properties, Prof. Charlton said.

"Our work has been focusing on how these can have an effect on the brain," she said.

## United approach to protected cropping

Western Sydney University (WSU) and Qatar University have announced a joint project around fertigation in protected cropping. The joint project was announced in July and will be led by WSU's Professor Zhonghua Chen.



Prof. Zhonghua Chen will lead a joint research project to benefit protected cropping in Australia and Qatar.

The aim of the 'Sustainable fertigation for high yield and quality vegetables in protected cropping' project is to identify novel, cost-effective fertigation, nutrient delivery and management approaches to growing greenhouse vegetables that produce increases in produce yield and quality, assisting commercial growers in both Australia and Qatar.

The research team, based at WSU's National Vegetable Protected Cropping Centre, will run fertigation trials in the Centre's high-tech experimental greenhouse. They'll investigate the impacts of reduced fertiliser use on crop yield and nutritional quality in two high-value fruiting vegetable crops: eggplant and cucumber.

The team will conduct experimental greenhouse trials, laboratory measurements and sensory tests on the effects of fertigation on the quality and nutritional profiles of the resulting crops, using various molecular, postharvest, food science and human nutrition methods.

Through these and comparative trials in Qatar University's experimental greenhouse, the project team will determine water and fertiliser input levels to guide practices in Qatari greenhouse vegetable production.

"Sustainability will be achieved through cost-effective optimisation of fertigation system operation and management in high-technology greenhouses to produce high-market-value vegetables, such as eggplants and cucumbers, of high nutritional and sensory quality," said Prof. Chen.



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*Siddharth Jadhav, CEO of Polybee, is using micro-drones for crop pollination in glasshouse environments.*

## Micro-drones could help solve Australia's glasshouse pollination problem

A new study is investigating whether small autonomous drones can effectively pollinate tomatoes and strawberries in Australian protected-cropping environments. Hort Innovation CEO, Brett Fifield announced the \$1.3M research project in July.

He said Hort Innovation with Singaporean technology service provider Polybee, Western Sydney University and major Australian grower, Perfection Fresh, hoped to use drones to improve labour and production efficiency in glasshouses.

Brett said pollination of tomatoes in glasshouses is often done by hand mimicking 'buzz' pollination. He also said strawberries represent an industry moving from typical field conditions and exploring the benefits of glasshouses, however honey bees, which are vital for strawberry production, do not cope well in a greenhouse environment.

Alternatives methods need to be explored to help industries succeed in protected cropping environments said Brett.

Polybee chief executive, Siddharth Jadhav, said the micro-drones, which are about 15cm x 15cm in size, hover over each cluster of flowers for up to 15 seconds in a glasshouse setting. He explained that turbulent air from the drone vibrates the flowers to disperse pollen, before the drone moves on to the next plant.

Trials will be conducted in protected cropping environments at Western Sydney University and at Perfection Fresh farms in South Australia.

SA



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# SOILLESS CALENDAR 2022

Check the event's website to monitor its current status.

2022  
United Nations International  
Year of Glass

## September 5-9

Greenhouse Technical Management  
Training Course: a Masterclass in  
Protected Cropping,  
Gatton Research Facility, Lawes, QLD;  
melinda.perkins@daf.qld.gov.au

## September 7-9

Asiafruit Congress Online Preview;  
asiafruitcongress.com/en/

## September 7-9

Asia Fruit Logistica 2022, Hong Kong;  
asiafruitlogistica.com/en/

## September 8

SoilWealth/ICP Workshop and Grower Tour,  
Virginia, SA (PCA member event), 9am-5pm;  
protectedcropping.net.au

## October 14

Fair Farms National Conference & Awards,  
Opal Cove Resort, Coffs Harbour, NSW,  
8am-11am;  
fairfarms.com.au/fair-farms-conference/

## October 25

PCA Sydney Regional Farm Tour, Western  
Sydney, NSW (PCA member event);  
protectedcropping.net.au

## November 1-4

Asiafruit Congress, Bangkok, Thailand;  
asiafruitcongress.com

## November 6-10

SIMA 2022, the Paris International  
Agribusiness Show, Paris, France;  
imexmanagement.com/shows/sima-2022

## November 9-11

European Sustainability Forum,  
Bonn, Germany;  
fruchthandel.de

## November 15


Global Berry Congress, Rotterdam,  
The Netherlands;  
berrycongress.com



## PCA grower tours have returned.

In August the focus was on IPM at  
Family Fresh Farm, Peats Ridge, NSW.  
The tour was lead by Wade Mann  
(above).

To find out more about future events  
see [protectedcropping.net.au](https://protectedcropping.net.au).




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*Perino tomatoes were promoted in store together with Old El Paso products such as tortillas and taco shells. The two brands partnered to support the Stephanie Alexander Garden Kitchen Foundation.*



*Award presentation (from left to right): James O'Shea, National Account Manager Costa, Tim Nitschke, Business Category Manager Fresh Produce Coles, Elisa Siliato, Marketing and Innovation Manager Costa, Simone Cacciatolo, Account Executive Costa, and Craig Taylor, General Manager Fresh Produce Coles.*

The longer-term benefit of this campaign also leads to better preventative health outcomes, meaning people live stronger, healthier lives, through minimising chronic disease that comes from poor food choices.

Elisa Silato said the MOYA award was also great recognition for all the team who work in the tomato glasshouses in Guyra, on the Northern Tablelands of New South Wales.

"They grow, harvest and pack our delicious

tomatoes, ensuring we have a consistent supply of high-quality produce."

Costa's operations include 40 hectares of glasshouses, located across two sites, as well as a 2.5-hectare propagation nursery. The two sites employ more than 800 people and produce up to 20 million kilos of tomatoes per annum.

**Brigid Veale is the Public Relations and Communications Manager for Costa Group.**



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S.D. & P.R. Dominello's stand at the busy Sydney Flower Market.

Keen to move into greenhouse cut flower production, they bought land near their rented farm. Sam notes that they were going through a wet cycle for the first three years, so they reaped the benefits of that initial investment in undercover growing (serendipity number 1). By 1995 greenhouses covered a total of 3.6ha, all located on a gentle east-west downhill slope.

## Family affair

These days there are 12 full-time and casual workers. Half are family members. They do as much as possible themselves, whether this is growing, picking, selling, making compost and growing media, refurbishing greenhouses or making postharvest solutions. Sam's role is Owner, Director and Chairman and all-round 'trouble shooter'. Phil is the other Owner and Director. Sister Vicki is Sales Manager and in charge of running operations at the Sydney Flower Market from the stands they own. Sam's wife Mandy is Office Manager and Financial Controller and her skills got them through the tough times. Phil's wife Roseanne keeps busy in the packing shed.

Driving to the farm to interview Sam and Phil, I realised that it was 30 years since I first visited their property. At first glance, the farm looked much the same as my last visit many years before, but I quickly learnt that there has been a radical shift in how the brothers grow their flower crops and run their business.

The greenhouses they built at the start using Australian steel remain in good condition. The structures are relatively simple with plastic covers, fans and vents. Heating, thermal screens and blackout curtains were added over time. Today, there are no outdoor crops and more than half the production area is heated for four months of the year to extend production. Hot water pipes run parallel to the irrigation lines. The water is heated using two thermostat-controlled, coal-fired boilers positioned in different locations on the farm. The brothers say it is the only affordable option.

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## Big thinking

The second instance of serendipity in this story was a chance conversation with an award-winning pumpkin grower. His massive pumpkin beat their entry in a local pumpkin growing competition. His secret he confided was worm castings and 'worm juice'.

This revelation led the Dominellos to explore the benefits of adding beneficial microorganisms to their production system. Initially they worked with a microbiologist to develop a 'brew' of beneficial bacteria and fungi but soon turned to vermitea or 'worm juice', which provides the same benefits with less work.

Earthworm beds are irrigated and the resulting liquid, the vermitea, is gravity fed into a large holding tank and circulated back through the beds daily to build up the population of beneficial organisms. After about a month, the vermitea is moved to a second holding tank ready to be applied to the crops. There is also a side income selling vermitea to other flower growers and local orchardists.

Diluted vermitea is applied to the crop throughout its life and Sam firmly believes this is the reason for their high-quality flowers. While it isn't high in NPK, Sam understands that the microbes in vermitea convert nutrients in the growing media into a form the plants can take up, meaning they need to apply less fertiliser. Vermitea also includes trace elements and plant growth enhancers such as cytokinins.

Applied through overhead irrigation, the vermitea runs down leaves and petals and further boosts the microbes in the growing media. It promotes plant growth and yield, and increases resistance to pests and diseases as plant leaves are so thick and healthy that the plants better withstand pests and diseases. Originally adopted to improve the quality of the flowers (longer stems, great colour in the buds and lush, crisp foliage), the brothers estimate that vermitea saves them tens of thousands of dollars in fertilisers and farm chemicals. Their worm farm featured in a segment called 'A drop of the good stuff'



Lily bunches in buckets of water on a trolley in the cool room. The trolleys are loaded onto a refrigerated truck for transport to market.

## Labour-saving tip

Flower growing is very labour intensive with limited opportunities to mechanise. One innovation allows the Dominellos to fill flower crates with fresh media for the next crop very quickly. They've built a trailer that is driven over the crates, so in just two hours, two workers can fill the crates in a 550m<sup>2</sup> greenhouse and they're ready to plant. It used to take four workers a whole day to do this with shovels. This is a critical saving when you plant 20,000 lilies each week.



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their stand. Eight years ago as others in the market swung further towards wholesaling and importing flowers, as an easier way of making an income, Sam and Phil reverted to only selling their own flowers. Their stand in the flower market stood out as different, attracting buyers.

Then came the transformational year of 2020, and more serendipity. Because of COVID-19 flower imports basically ceased and the market was empty. Suddenly only selling their own production was a huge advantage. Sam and Phil quickly planted crops that were in demand. The unexpected bonus was record prices. Locally grown flowers are now more competitive than they used to be. More florists and consumers want locally grown flowers and the past two years have been fantastic say the brothers.

## Looking ahead

What's ahead for the rest of 2022? The Dominellos enjoy learning new things from others in the industry and later this year Sam and wife Mandy are looking forward to a study tour of Japan where they will visit lisianthus and dahlia growers to exchange knowledge. Sam says he learns best from visiting other growers and sharing techniques with them.



*Roseanne and Phil working hard in the packing shed getting ready for the next day's market. Bunches are sleeved and wrapped. All flower sleeves and wraps are branded.*

Sam is on the board of the Central Coast Plateau Chamber of Commerce, which is working hard to help farmers and protect the region into the future. He sees a bright future for new people joining the industry, especially in protected cropping.

"There is a big future here, growing flowers, herbs and food crops," says Sam. "Protected cropping is win, win – less water, less chemicals, more first grade production. The big issue is whether or not local councils understand protected cropping and allow developments to go ahead."

Beyond this year Sam is looking forward to helping his daughter with her new business, a wedding venue being set up on the property – The Ridge Estate. They have now purchased additional land nearby to be developed for agriworker and tourist accommodation.

Phil plans to continue flower growing and his kids are now the fourth generation involved in the business.

**Bettina Gollnow is Communications & Extension Manager for WildFlowers Australia, the national industry association focused on producing Australian and closely related South African species for the floristry industry. She has also just published the 2nd edition of *What Cut Flower is That? The essential care and handling guide for cut flower professionals* with co-author Delwyn Thomas.**

**Previously she provided extension support to the commercial New South Wales cut flower industry as the Industry Development Officer (Floriculture) for the NSW DPI for more than 18 years. It was in this role that she first met Sam and Phil Dominello.**



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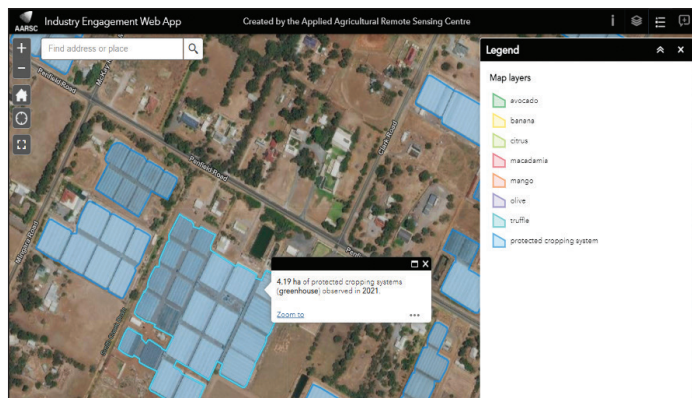


Figure 2: Screenshot of IEWA showing PCS map (blue features), and attributes associated with each feature—in a pop-up.

(block, variety, yield, etc) or personal information (grower, enterprise, owner) is included. The map is built to the national standards of the Australian Collaborative Land Use and Management Program, coordinated by ABARES.

## Progress update

The national mapping program is progressing by growing region (Figure 1). After completing the field validation stage in Western Australia, Tasmania and Adelaide – each has progressed through peer review and is now published. The Northern Territory was field validated in June and is now available for peer review. Elsewhere, draft mapping (where available) can be viewed in the industry Engagement Web App (IEWA – [une.edu.au/webapps](http://une.edu.au/webapps)).

PCS mapping is presented as a single class with additional information for 'system' type available within a pop-up. (Figure 2). The system types shown are either: greenhouse (including all glasshouse,

polyhouse, polytunnels); or net (shadehouse and permanent nets). The observation year reflects the date of imagery used to map the feature or the field observation (whichever is most recent).

In Western Australia and Tasmania, where mapping has progressed through peer review to published – we can derive summary statistics for the total area of PCS in each State. For Western Australia, the map shows 818ha (334ha greenhouses; 484ha nets), and in Tasmania 1280ha (506ha greenhouses; 774ha nets).

The IEWA supports the peer review of draft mapping where external feedback by growers and experts can be submitted as comments, which are then interpreted by the research team and actioned (including a response).

## Help us, help you

Stakeholders are encouraged to contribute by viewing the draft mapping and adding their feedback. This engagement is extremely valuable and is essential for mapping new systems that are not visible in satellite imagery due to the currency (date) of image acquisition. The app includes simple capabilities that allow anyone to add a feature (as a point or polygon) on the map and provide their feedback as a comment.

As the national map program progresses, mapping is updated and published into the IEWA, which at minimum presents all regions completed to draft stage. The mapping team also interprets all surveys (PCS Survey) and feedback comments (IEWA) received, so these features are also published regardless of the stage of the map tile they reside in.

The success of the mapping showcases the value of science and innovation across the horticulture industry in Australia. The maps built spatially enable Australia's horticulture industry and support data-driven decision-making.



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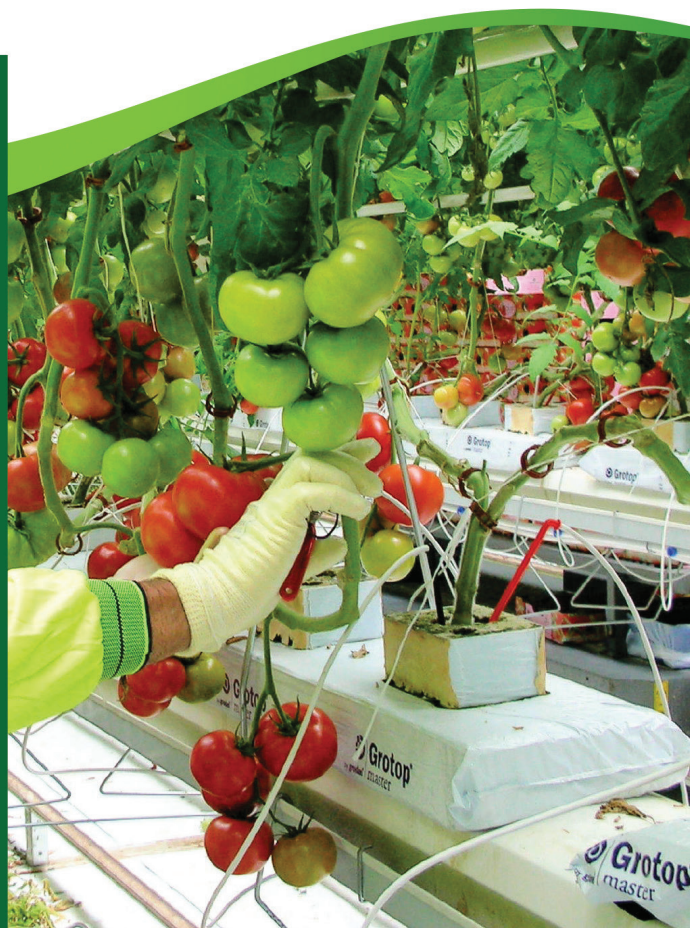
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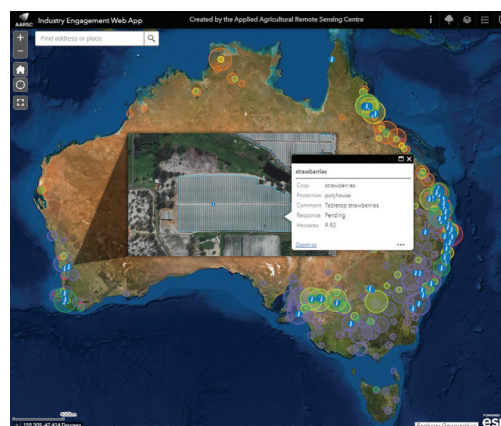


Figure 3:  
IEWA showing  
a feedback  
comment  
submitted.

## You can contribute!

The AARSC team has included a 'National Map of Protected Cropping Structures' section within the Industry Applications Gallery (see [www.une.edu.au/webapps](http://www.une.edu.au/webapps)). This webpage includes content that supports the project and importantly industry engagement, which is enabled via two location-based tools:

### PCS Survey (best for mobile)

Help build the national map of Australia's protected cropping systems by completing this 60-second survey in four simple steps.

1. Click the link to launch the survey. It will open in any browser on any device. To find the link visit [www.une.edu.au/webapps](http://www.une.edu.au/webapps) and follow the prompts to the survey.
2. Add location of the protected crop by clicking on the map:
  - Either select the cross-hair button to quickly 'find my location' or search for an address; or
  - Place the pin on the protected crop by clicking the map and continue the survey. From a mobile device confirm the location by selecting either the 'tick' button (✓) or the back arrow (←) button in the top-left corner to continue the survey.
3. Select system type and optionally include the crop and a photo.
4. Click 'submit' to complete the survey!

### Industry Engagement Web App (best for desktop)

The IEWA supports peer review of the map, where external feedback submitted by growers and industry experts can be submitted (as comments), which are then interpreted and actioned (including a response) by the research team (Figure 3).

Anyone can review the map and contribute (for best experience open at your desktop). Instructions are available from the 'Information tool' on the top right of the screen. If any systems are missing or incorrectly mapped, or a new system built – simply add a comment to bring it to the attention of the research team. The AARSC team will review and action each comment and provide a response. Updates to the map, based on your comments, will then be visible in the next update.

#### More information

Contact: Craig Shephard: [cshepha2@une.edu.au](mailto:cshepha2@une.edu.au) or  
Andy Clark: [andrew.clark@une.edu.au](mailto:andrew.clark@une.edu.au)

#### Acknowledgement

This project is funded by Hort Innovation through the Hort Frontiers Advanced Production Systems Fund with co-investment from Future Food Systems CRC, Protected Cropping Australia LTD and Greater Sydney and North Coast Local Land Services and matched funding from the Commonwealth Government. AARSC is fortunate for the support of the project partners in this initiative.







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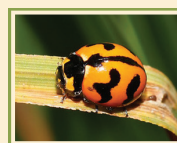
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## Was this early hydroponics?

From the basic definition of hydroponics as 'soilless culture' the hanging gardens obviously couldn't be considered to be strictly hydroponics as they were soil based. However, they did use the technique of having soil as a growing medium in containers separated from the general soil. They also used relatively sophisticated irrigation techniques. Both of these indicate to me that this is an admirable predecessor of hydroponics, and worth its place in the history of hydroponics.



would only be found once it was ruined. Their inscriptions read: "Belonging to Sennacherib, king of the world, king of Assyria". Inscriptions on the outside blocks add: "I caused a canal to be dug to the meadows of Nineveh. Over ravines I spanned a bridge of stone blocks. Those waters I caused to flow over upon it."

Parts of the arches to let the river water under the aqueduct survive. Interestingly, their shape is the same as those on the bas-relief that depicts the hanging gardens.

This was an engineering masterpiece for any age, let alone 2600 years ago and 500 years before the Romans built their aqueducts. The planning and building of the canal and aqueduct clearly shows that Sennacherib and his engineers had the skills needed to build hanging (elevated) gardens. The canal would also have provided the extra water needed to irrigate the gardens.

The water screws described by Sennacherib are a form of Archimedes Screw, however, Archimedes lived centuries later. This does not appear to be a problem because contemporary accounts from the time of Archimedes tell that the screw was already known outside of Greece.

Diodorus Siculus, who we heard from earlier, states that the garden looked like an amphitheatre and gave its size and shape: "The park extended four plethra (123m) on each side, and since the approach to the garden sloped like a hillside and the several parts of the structure rose from one another tier on tier, the appearance of the whole resembled that of a theatre."

An important aspect of the legend concerns Nebuchadnezzar's love for his wife Amytis, but there is no mention of her anywhere in his records. However, there is a romantic quote in Sennacherib's inscriptions: "And for Tashmetu-sharrat the palace woman, my beloved wife, whose features the Mistress of the Gods has made perfect above all other women, I had a palace of loveliness, delight and joy built..." The palace was built before the gardens.

## Modern archaeology

To prove whether there were hanging gardens at Nineveh, surely it is only a matter of doing more digging. Unfortunately Nineveh is on the edge of the modern city of Mosul, which a dangerous and war-torn city. Although the Iraqis are carrying out some archaeological work, it concentrates on the critical task of protecting the remnants of the palaces. Apart from the original destruction, a mixture of weather damage, looting and urban encroachment has put Nineveh on the Global Heritage Fund's list of 12 sites most "on the verge" of irreparable destruction and loss. Physically searching for the hanging gardens will have to wait for peace at Nineveh, if that ever comes.

## References

Dalley, Dr S., *The Mystery of the Hanging Gardens of Babylon: an Elusive World Wonder Traced*, Oxford University Press, 2013

Jacobsen T. & Lloyd S., *Sennacherib's Aqueduct at Jerwan*, University of Chicago Press, 1935.

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## Current cultural control methods

1. The first step is that an IPM approach is in place dealing with all other pests (at present dealing with mirids poses the most difficult problem).
2. Maintain good hygiene with the removal of all non-marketable berries from plants and elimination of any fallen fruit. These must be destroyed by being placed in a sealed bin so any adult flies die and do not escape.
3. Trim plants to remove suitable habitat for adult SWD.
4. Decrease planting density (blackberries and raspberries) to reduce humidity and shading in the crop.
5. Use herbicide or other controls to keep the area under plants bare.
6. Use screens/curtains around the edges of the crop from where SWD may invade as well as tightly woven nets to cover tunnel ends and leg-rows.
7. Use commercially available bait traps outside the crop area and on the perimeter where SWD is likely to be breeding.

require more structural support than typical shade netting, particularly more so in some areas due to greater wind resistance of the net. This could cost approximately \$100,000 to \$150,000 per hectare. Some growers may choose to drape netting over the tunnels but the high risk of wind damage to the net may mean that this is not the best option for most locations in Australia. Another alternative is to net the leg rows and tunnel ends with additional 'verandah' space at tunnel ends to help with access (estimated \$15,000 to \$20,000 per hectare). One additional benefit would be reduced cost of controlling caterpillars and mirids, with reduced disruption of WFT and two-spotted mite control by beneficial species from not spraying for mirids.

**Changes to picking schedules** may be required on some farms to make sure all ripening fruit is picked. If picking is already every two days (raspberries, blackberries and strawberries) then probably no change is needed but three-day intervals may be too long. Labour costs will obviously vary across farms but may be up to 25-50 per cent higher to ensure no ripe fruit is left.

**Disposing of all fruit off farm** or in sealed containers is required to remove all potential breeding sites for SWD. Extra

costs will be associated with labour to collect, remove and handle all the waste berries (including any fallen fruit). Potential costs to for the collection and exchange of sealed bins or to truck waste fruit off-site to a compost facility could also be quite significant.

**Changed canopy management** is necessary to make the berry crops less attractive to SWD adults. Additional labour for leaf removal could cost around \$7500 to \$10,000 per ha per year for strawberries (estimated at 300-400 labour hours) and \$6000 to \$8000 for raspberries (estimated at 250-300 labour hours).

**Increasing plant spacing** may also be required to reduce the density of the canopy to make it less conducive environment for adult SWD. Reducing plant numbers per hectare is difficult to accurately estimate since the remaining plants could compensate in yield per plant, and savings made with purchasing less nursery material and reduced picking and management costs. For this instance, we have assumed that a 25 per cent decrease in plant numbers will result in a corresponding yield loss of 15 per cent for strawberries and 25per cent yield loss in raspberries and have estimated the financial impact based on this yield decline only. The estimated loss for strawberries

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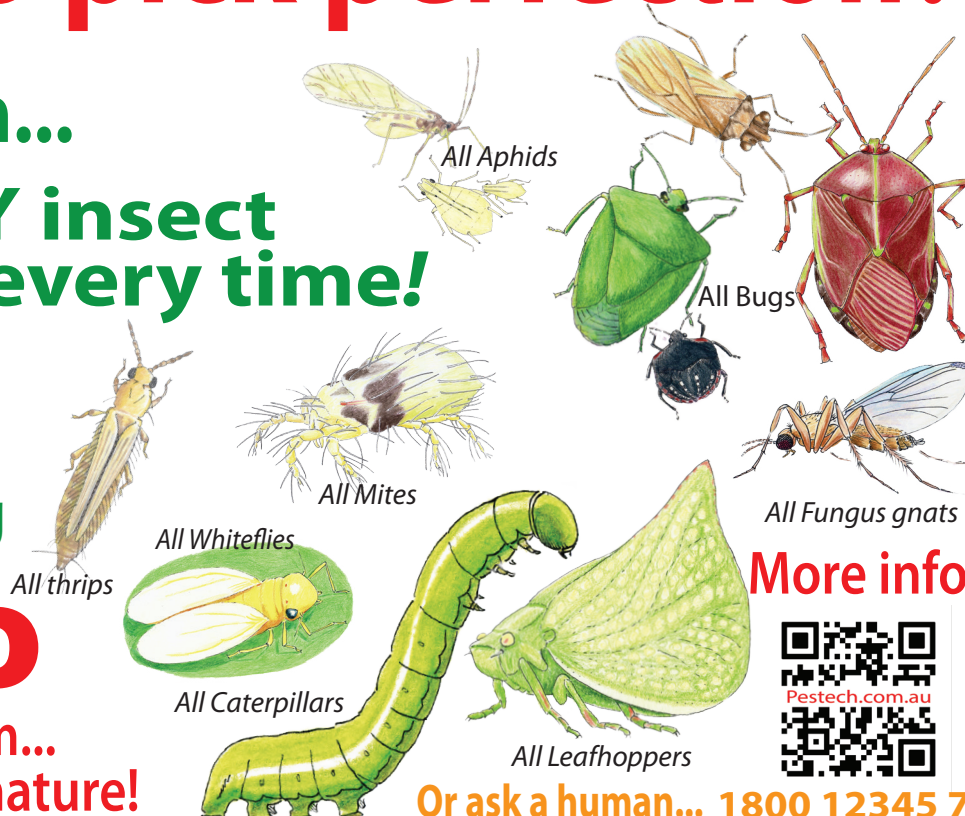
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Rebecca Addison is based in Tasmania. Dr Paul Horne established IPM Technologies in 1996.

is \$62,000 per ha. This has been estimated based on single hydroponic tabletop production (70 rows at 100m long) with standard density of eight plants per metre with an average yield of 800g per plant per year reduced to six plants per metre, with \$9.25 per kilogram used as the market price.

For raspberries the estimated loss is \$142,000 per hectare estimated using a reduction in yield from 20 tonne to 15 tonne per hectare per year, (assuming 0.66 plants per metre or 5681 plants per hectare reduced to 0.9 plants per metre or 4167 plants per hectare, at a market price of \$21 per kilogram).

**Trap plants** at the ends of rows in protected cropping production systems is not something that is used at present overseas, but in conjunction with bait sprays this may prove an effective control. If adopted,

then there would be a loss associated with non-productive plants that still need to be maintained and picked. This includes plants maintaining a full canopy, around 1m from the end of each row, thus 2m in total per row. This in yield reduction alone could cost approximately \$8000 per hectare per year for strawberries and \$7000 per hectare per year for raspberries (costs calculated using the same figures above for standard density plantings). These would need ripe berries harvested and destroyed every four to five days, which would be an additional cost imposition. However, if effective, this may mean that netting is not required and so reduce the cost there.

**Bait traps** are widely used, although sentiment from growers overseas is that their impact may be far less than desired. Depending on the type of traps used and

the density of placement, the costs could be around \$1100 per hectare per year for the traps alone (calculated based on using M2i traps at \$9 per trap, density of 20 per hectare, replaced every six weeks). The labour to place these out and replace every six weeks would be an additional cost to the grower.

We do not know when or if this pest will arrive in Australia, and if it does, how will it survive under Australian conditions. But if it does arrive and finds conditions favourable, growers will need to be prepared to make some changes and these could be costly. All dollar values are at 2022 figures and so can be adjusted accordingly in the future.

**Rebecca Addison is a consultant at IPM Technologies in Tasmania where she assists farmers to develop and implement IPM strategies to manage insect pests in their crops. Rebecca has an extensive background in agronomy and production of soil and hydroponic berry crops with a focus on pest and disease management, irrigation and nutrition. Dr Paul Horne is the director and entomologist at IPM Technologies Pty Ltd ([ipmtechnologies.com.au](http://ipmtechnologies.com.au)), which he founded in 1996. He is based in Hurstbridge, Victoria. Paul's interests are in facilitating adoption of IPM to manage invertebrate pests in a wide range of crops.**

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# Aphid spring

This issue of *Soilless Australia* features cut flower production and most flower growers rate aphids near the top of their list of enemies. But soilless cropping also includes fruit and vegetables...aphids love them all as Ion Staunton explains.

There are many aphid species. Green peach aphids have been listed as pests on hundreds of plants; most aphid species have varied taste preferences beyond the common name they carry such as rose aphid, cabbage aphid, black bean aphid and other you-name-the-plant aphids.

No magnifying glass is required for identification. You recognise them as a crowd encrusting the growing tips. You can see light through aphids; a thin abdomen shell full of transparent sap. They get to about 4mm, their jointed antennae extend forward more than half the length of the body, they have piercing and sucking mouthparts and, at the rear, two cornicles, like a pair of guns pointing upwards/backwards. When adults have wings, both are membranous; the forewing much larger than the hindwing.

## Life cycle

Spring brings an explosion in aphid numbers. How come this population eruption happens so quickly? Tick the usual factors: warmth, humidity, succulent new shoots to literally get stuck into



*Aphid w-less: Adult aphids may be winged (top left) or wingless (above left). Drawings by Ion Staunton. Above, right - Aphids such as these rose aphids are easily seen on new shoots and buds.*

and reproduction without sex to save time. Sex is sort of optional but is required to lay male and female eggs, which are the usual overwintering stage in temperate zones of Australia.

After the first generation, adults are usually wingless, mostly female producing living female young. From 10-20 generations a year is possible with numbers highest in the tropics where winter is less an issue.

## Damage

With their mouthparts inserted into the sapstream they hardly have to suck. The plant phloem (bark) is loaded with sugars after photosynthesis in the leaves. The aphids can't handle all those carbs, which is why the liquid called honeydew is excreted out through those cornicles.

Ants just love it. It's almost like a gangland protection racket: the aphid excretes payment so the ants don't eat them and may even protect them from various predatory insects. The sugary 'spillage' ferments and darkens into what is called sooty mould and, if it settles on your crop, the market won't buy it...or pays you less.

Then there's the physical damage to your crop. A little insertion mark is not such a big deal on a stem but leaves and buds often become distorted. If there are too many suckers then the bud or fruit falls off. Less yield!

Finally viruses, which are very tiny and easily transmissible, are transmitted by aphids directly into the sapstream as the aphids feed.

## Control

There are many beneficial insects that enjoy a three-course meal of aphids, aphids and aphids. Tiny wasps and ladybirds (larvae and adults) head the list. These do a good job in protected cropping situations, however if the aphid population does get out of hand, instant-kill insecticides such as natural pyrethrum, kills all aphids in about a minute. That is immediate job satisfaction! Natural pyrethrum degrades in a couple of hours of UV light (sunshine) and beneficials can be reintroduced to maintain control.

If your crop is flowers, systemic insecticides that flow through the sapstream provide protection for a couple of weeks without the concern of withholding periods applying to edible crops (read the label).

**Ion Staunton is an entomologist at [pestech.com.au](http://pestech.com.au) maker of Py-Bo Natural Pyrethrum Insecticidal Concentrate. Send your pest questions by text to Ion at phone: 0407 308 867, or email Ion at [ion12@me.com](mailto:ion12@me.com).**



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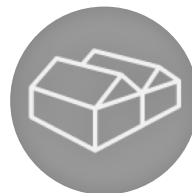
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